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Safety Apparatus for Steam Boats, being a combination of the Fusible Metal Disk with the common Safety Valve. By A. D. Bache, Professor of Natural Philosophy and Chemistry in the University of Pennsylvania.

Among the causes which produce the explosions of steam boilers, no one stands more prominent, whether we have regard to the frequency of the explosions caused by it, or to their violence when they occur, than a defective supply of water within a boiler when in action. When the supply of water afforded to a boiler, is insufficient to compensate for the water which is converted into steam, the level of the fluid within is lowered; the boiler itself becomes heated, often intensely, and the steam partakes of this temperature without, from an insufficient supply of moisture to give the density corresponding to that temperature, having a corresponding elastic force. Of the existence of such a state of things within a boiler, the ordinary *safety valve* gives no indication, the tension of the steam within is not sufficient to overcome the weight with which the valve is loaded; it not only ceases to deserve the name of *safety* valve, but the opening of it, by hand, may be the very means of producing an explosion: for the escape of steam, thus permitted, relieves the water within the boiler from pressure; the fluid rises in foam; and being thrown into contact with the heated sides of the boiler, (or, as is supposed by some, being projected into the hot and unsaturated steam,) is flashed into steam, too considerable in quantity to find a vent through the valve, and of an elastic force sufficient to defy the controlling

power of the materials used in the construction of the boiler. The raising of this valve is not necessary to the production of an explosion in the circumstances supposed, a supply of water suddenly introduced will produce the same dreadful effect. That such circumstances have frequently occurred, and have as frequently caused the results above described, is fully shown by the various authentic accounts of explosions on record.

The memoir of M. Arago, a translation of which is contained in the Journal of the Franklin Institute,* furnishes proofs of this fact; and the explosion of the boiler of the Chief Justice Marshall, during the last summer, has, I conceive, been fairly referred to the occurrence of similar circumstances.

The French Academy, when called upon, in 1823, to report to their government, the precautions to be used to prevent the explosions of steam boilers, satisfied of the insufficiency of the common valve to insure safety, required that in addition to two safety valves of the ordinary construction, one at the disposal of the engineer, the other under lock and key, there should be two plates of fusible metal covering apertures in the boiler; the one having its melting point at 18° F. above the temperature of the steam, which, according to the statement of the proprietor, made when his engine was established, was required to be used in the engine, the other at 18° above the fusing point of the first: the fusing point of each is thus, even in a high pressure engine, much below the temperature to which the boiler being heated there would be danger of explosion.† Now whether the steam be very elastic or not, so soon as it, or the boiler, arrives at the temperature requisite to fuse these plates, they melt, and the steam is discharged; this, too, below the limit of temperature at which such a discharge of steam would, according to the statement made in the former part of this article, be attended with danger.

These plates are made of alloys of bismuth, tin, and lead, in proportions varied according to the temperatures at which they are required to melt; by covering each with a piece of fine wire-gauze, it is prevented from swelling out by the effect of softening as it verges towards the fusing point.

Experience has shown that these plates can be relied on, confidently, to answer the ends proposed. In the stationary engine we should thus, by borrowing from our brethren abroad, be provided with a certain remedy against explosions caused by the circumstances we have endeavoured to explain, and also against the bursting of the boiler from an accumulation of steam within, should any accidental derangement of the common safety valve prevent its action. This device would be of the greatest value if applicable to steam boat boilers, for, being entirely without the control of the engineer, caution would be produced by the fact that any attempt to

* Vol. v. No. 6, and vol. vi. No. 1, 1830.

† Iron at a dull red heat has a temperature of 947° F. while steam of eleven atmospheres corresponds according to the late determination of Arago and Dulong to a temperature of 367.34° F.

raise the steam above the proper pressure, or any inattention to the supply of water within the boiler, would be immediately made known to the captain and passengers by the noisy efflux of steam through the aperture opened by the melting of this tell-tale plate. If the plate were placed within sight of the passengers, the only means of an improper kind, to which the engineer could resort, to prevent its fusion, (sometimes practised in the stationary engine in France, according to M. Arago,) viz. keeping it cool by the application of water to its surface, would be entirely cut off.

The reason why this plate has been considered inapplicable to steam boat boilers, in general, is obvious; when the plate melts, all the steam must escape from the boiler, and the apparatus must cool before it can be replaced by a similar plate; this sudden desertion of the prime mover of the engine might, in certain cases, put the lives of the passengers in almost as great jeopardy as an explosion; instances, in an exposed navigation, will readily occur on reflection, such as a boat on a lee-shore, &c. In all cases such a desertion would be attended with very great inconvenience.

The remedy for this, and one which simplicity and consequent ease of application seem to recommend very particularly, will now be stated. If, as is hoped, this apparatus shall be found to remove every objection to the use of the fusible plate in the boilers of steam boats, it will insure the exemption of passengers from a portion at least of the dangers to which they are now so often exposed.

The method, which I would propose, is to combine the fusible plate, with the ordinary safety valve. Such a plate affixed to an opening of a proper size, in the boiler, as near as may be practicable to the highest line which is exposed to the direct action of the fire, is covered with a hollow cylinder, of a greater diameter than the aperture covered by the plate, the base of which presses upon the edges of the plate, while the top is arranged as the seat for a conical, or flat valve, of the ordinary kind; this valve will be habitually open, and when required to be used to prevent the escape of all the steam, will be pressed down, as is usual, by a weight acting by the intervention of a lever. This apparatus should be so placed upon the boiler as to be seen by the passengers, who are thus enabled to know that all is right, while the lever attached to the valve is in an elevated position, showing that the valve is raised from its seat; this lever is kept in its raised position, by a cross bar, supported on uprights, to which it is attached by a strong chain fastened by a padlock; the key of this lock being in the possession of the captain of the boat, the chain cannot be slipped, and of course the lever cannot be lowered, to close the valve, except through his agency. Suppose the steam or the boiler to become heated to the fusing point of the plate; it melts, steam issues through the small cylinder covering the plate, with a noise, which even at night would arouse the captain and passengers; if no danger will be incurred by loss of steam, and the consequent stoppage of the engine, such an escape should be allowed as a mea-

sure of precaution, though it is by no means one of necessity, since the limit of temperature producing fusion is much below that required for explosion. The alarm given, the steam gauge, should derangement of the safety valve have prevented its action, or, the usual practical observation upon the issuing steam, will show whether the fusion of the plate was caused by an accumulation of steam, or by the defective supply of water; this may be further tested by the gauge cock; should it prove that the water is below the usual level, a supply can be introduced without danger. A second plate, arranged in a similar manner to the first, fusible at say 20° F. above this, should be also provided, that the same means of safety may remain in case of accident to the first plate. The vigilance of the engineer would almost be insured by the use of these plates, from a knowledge that his inattention could not escape detection and its consequences. Passengers would be guarded against the results of carelessness, should it exist, and captains, as well as the public, would have the means of knowing accurately the value of those employed in the responsible station of engineers. The want of patronage which would inevitably attend an ill regulated engine, would soon correct evils now so formidable.

By the annexed figures, the method of arranging the fusible plate and safety valve, is shown in detail.

Fig. 1.

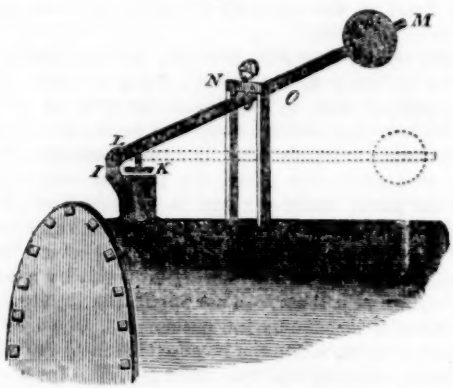
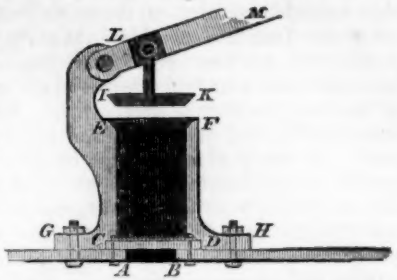


Fig. 1, represents an oblique view of part of a boiler with the safety apparatus attached. An unfavourable case, as to the space occupied by the apparatus, is taken, namely, that of a high pressure boiler required to work with steam of 150 lbs. bursting pressure, (ten atmospheres,) rendering it necessary to load the valve with rather more than 150 pounds.

Fig. 2, gives more in detail the method of arranging the fusible plate, &c. being a section of the apparatus. The area of the aperture closed by the plate is taken at 3 square inches, which is one half more than the area of the safety valve commonly used in a high

pressure boiler of 3 feet in diameter by 10 feet in length. A, B, Fig. 2. is the aperture closed by the plate, C, D, of fusible metal, covered by a piece of wire gauze to prevent the plate from yielding as the temperature approaches its point of fusion. The plate is surrounded by a cylinder, E, F, G, H, of a greater diameter than the plate, terminated, above, by the valve seat E, F. Should the fusible plate, in giving vent to the steam, be thrown upwards, as an expression used by Arago in relation to it, gives reason to suppose, the valve should not be in the cylinder, E, F, G, H, but in one at right angles to it, so that the valve seat should not be vertically over the fusible plate. The valve, I, K, is represented of the usual form, though it may be questioned, whether this is the best which can be given: it is drawn in the position which it should habitually have, that is, so far raised from the seat as to give an opening for the escape of steam, equal in area to the valve.

Fig. 2.



To retain the valve in its position, the lever L, M, Fig. 1, is fastened to a bar of iron, N, O, (supported by the uprights N, P, and O, R, of the same material) by a chain, which is attached to N, O, at one extremity, and which passing round the lever, returns through an opening in N, O, to the top of the bar, where it is secured by a padlock. In the drawing the area of the valve, I, K, is $4\frac{1}{2}$ square inches; this, at 150 lbs. to the square inch, requires a weight of 675 lbs. to press it down. The short arm of the lever is $1\frac{1}{2}$ inch, the long arm 30 inches, the weight, T, is then about 33 lbs.

To raise the valve sufficiently above its seat, requires in the case figured, stanchions of 12.4 inches high. The whole apparatus thus occupies less than 3 feet in length, and 18 inches in height. The dotted lines represent the position of the valve when, after the fusion of the plate, it may have been closed.

On the importance of Hygrometric Observations in Meteorology, and the means of making them with accuracy.

The importance of hygrometric observations as forming a part of a meteorological journal, especially since we are now furnished with a hygrometer, which will inform us with certainty, not only of the relative quantity of vapour in the atmosphere, but of the absolute quantity, has induced me to offer a few remarks on this subject to the members of the Franklin Institute, for their consideration.

The object I have in view is to induce the Institute to use their

influence to have meteorological journals kept in different parts of our wide extended country, on the same plan, and published in the Journal of the Institute monthly. Many persons, for their own private gratification, are now keeping very imperfect meteorological journals, who would feel a tenfold interest in the subject if they were informed by the Institute how to keep a much more perfect journal, with no more trouble, and at the same time contribute greatly to the public good. As many persons in the country may be willing, at the suggestion of the Institute, to keep a journal, who are not furnished with a Daniell's or Jones' Hygrometer, it may be useful to know how its place may be supplied. Any contrivance to obtain water in a common tumbler, cold enough to cause moisture to settle on the outside, will answer the purpose. During the summer months I have generally found pump water sufficiently cold, and in other months I have used ice or snow, and in very cold weather I have been obliged to have recourse to salt and snow. Any of these methods I consider preferable, both in simplicity and accuracy, to Daniell's or Jones', for by mingling waters of different temperatures, one above, and the other below the dew point, the exact point may be obtained to great nicety in a short time—whereas in using the evaporation of ether, the temperature is suddenly depressed below the dew point, sometimes to a considerable distance, and it requires much more time and skill to arrive at even tolerable accuracy.

However, when I could not procure ice or snow, I attached a small piece of muslin, or a thin piece of sponge, to one side of the bulb of a common thermometer, and poured a small quantity of ether upon it, carefully watching the naked side to see when the dew began to settle on it. When it settled very rapidly the thermometer had sunk below the dew point—but by wiping off the dew, and letting it settle again repeatedly, I could obtain a pretty accurate result. I have frequently compared these results with those I obtained by means of the cold water in the tumbler, and the agreement was very satisfactory.

In taking the temperature of the air, also, great care is required or errors will be committed. If the thermometer is surrounded by bodies either hotter or colder than the air, it will be affected by radiation—in the former case, it will give a temperature too high; in the latter, too low. In a clear calm evening, after sun set, I have known a thermometer placed near the ground and exposed to the open sky, to indicate from 8 to 12 degrees below the temperature of the air, which may be obtained nearly by swinging the thermometer rapidly round. So, during the day, if it is exposed to bodies heated by the sun, it will sometimes be several degrees warmer than the surrounding atmosphere which is not heated by radiation, but only by contact with solid bodies.

In cloudy weather, however, no such effects take place, for then the surface of the earth, and all other solid bodies, have their radiated caloric returned by the clouds, and consequently, they retain the temperature of the air. On cloudy nights the surface of the

earth does not cool below the *dew point;* and, therefore, there is no dew. Even in clear nights, when the dew point is very far below the temperature of the air in the day, the surface of the ground does not sink in temperature to the dew point by radiation, and in such case also no dew is formed. I have observed in August, when the dew point has been as high as 76° Fah. when the temperature of the air during the day was above 90°, that but little dew was formed during the night, in the city of Philadelphia. No doubt more was formed in the country, where the surface of the ground was not exposed to radiation from hot brick walls. Be that as it may, I never saw dew begin to form on the grass in my yard, until its temperature had sunk to the dew point. Indeed, no reason can be imagined why it should settle on the grass before it is cooled by radiation to the dew point, any more than on a tumbler of water above the dew point. The phenomena are the same. The dew does not, in either case, fall through the air; but the vapour which is in the air, equally diffused by its own elasticity, when it comes in contact with solid bodies, cooled by radiation or otherwise, below the dew point, is deprived of so much of its caloric, that it is no longer able to maintain its elastic state, and is precipitated in the form of dew.

An objection may be urged against this theory, which at first appears plausible. It is known that dew does not appear under a shed, or even under a covering of thin muslin spread out at the distance of some feet from the ground, and therefore it is inferred that dew falls through the air from the upper regions. The true reason, however, is, that the temperature of the grass, or other bodies under the cover, does not fall to the dew point, the radiations being returned by the cover, which may easily be ascertained by placing one thermometer under the cover where there is no dew forming, and another in the grass, beyond the cover, where the dew is forming, when the difference will be detected. I have seen a difference of 8 or 10 degrees under the protection of a silk handkerchief, even when the air had a free passage between it and the ground.

Hence is demonstrated the great utility of even thin coverings over tender plants during clear nights in the spring, when the surface of the ground is likely to be cooled by radiation down to the freezing point. Plants so protected may be preserved, while those in their neighbourhood, unprotected, will be entirely destroyed.

Another argument against the theory of dew here proposed is, that the lower parts of the atmosphere do not contain vapour enough to form such heavy dews as sometimes appear—when more vapour is precipitated than is contained in a hundred feet of the atmosphere, in height, and it cannot be presumed that all this air comes in contact with the surface of the earth during a calm night when the dew is the greatest.

But this objection will have no weight, when we recollect what Dalton, I believe, first demonstrated, that aqueous vapour is not supported by the air, but by itself. Or, in other words, if the air should be suddenly annihilated, the aqueous vapour which is now diffused through it by its own elasticity, would neither sink upon

itself, nor expand to a higher elevation; but its own elasticity would just be able to support its weight without further condensation. If now we suppose the lowest stratum of this vaporic atmosphere to be changed into dew, it is manifest that the whole vaporic atmosphere must descend; and this takes place, whether we suppose an atmosphere of common air or not: a longer time will be required to settle through the air than if there was none; but the ultimate effect is the same in both cases.

Indeed the hygrometer itself affords a most satisfactory proof, that aqueous vapour is not supported by atmospheric air; for it is no uncommon thing for the dew point to remain the same through the night—indicating that the density of the vapour continues unchanged; which could not be the case if vapour was supported by the air. For, as vapour is only about one-half the density of air, even when at its greatest density, unless compressed by art, it would rise rapidly through the air, from its levity, and leave the lower parts absolutely dry during the night, whilst no vapour is sent up from the ground to take the place of that which, by supposition, has ascended into the upper regions of the air. Surely it will not be said that vapour is sent up from the ground at the very moment dew is deposited there.

It must not, however, be supposed, that after vapour is condensed into cloud, it continues to press only upon the vapour below it. Part of its weight is then supported by the air, and the vapour below being relieved from part of its pressure, immediately upon the formation of the cloud, expands, and the dew point falls, as will be shown hereafter.

It is well known that the increase of aqueous vapour in the atmosphere, over a particular region, will depress the barometer, because this vapour is only about one-half the specific gravity of common air; but there are so many causes which produce a depression of the barometer, besides the rise of the dew point, or increase of moisture in the air, that a fall in the barometer is not an infallible sign of rain; yet I have no doubt that these two instruments united will enable the meteorologist to predict rain with absolute certainty, after a sufficient number of observations have been made to eliminate by induction a general law.

In the course of these observations, no doubt many curious facts will be discovered which the present state of science does not enable the philosopher to predict.

I will mention one here, which was so contrary to my anticipations at the time I first observed it, that for a while I doubted the possibility of ever arriving at any useful knowledge on the subject.

In the summer of 1829, there had been a very long period of dry weather, and I had been for many days taking the dew point very frequently, with much anxiety to discover the first indications of rain, when suddenly all my hopes were extinguished, by a fall in the dew point of several degrees in the course of half an hour—but to my great astonishment, in about 2½ hours, there came up one of the most violent showers I ever witnessed.

For several days previous to this, the barometer had been falling, and the dew point rising, (showing that the watery vapour was increasing,) whilst the temperature of the weather had remained nearly stationary.

I had been very particular in taking the dew point, so that I felt pretty confident no error was to be attributed to the observation; but still I was anxious to have an opportunity of witnessing a similar result.

Nothing similar was observed, though it might frequently have occurred, until the 16th of July, 1830, when I witnessed the following remarkable phenomenon. The weather had been very warm and dry for some days, the hygrometer being nearly stationary at 74°, for I had taken the dew point very frequently, and on the day of the present occurrence, I was sitting with the means of taking the dew point with me in my yard, when I perceived it suddenly sink 3 degrees, in a few minutes, and at the same time I observed a cloud forming immediately over my head, and in a few minutes more, the whole time not more than half an hour, a gentle shower of rain succeeded, hardly enough to wet the pavement.

Immediately after this shower the dew point rose again to its former elevation, 74°.

Not long after this I had the satisfaction of recording an observation of the same phenomenon, which renders it absolutely certain that sometimes, at least, the dew point sinks rapidly, and to a great extent, while it is raining in the neighbourhood.

From July the 16th to the 19th, the dew point gradually rose from 74° to 76°; it then remained stationary at that point, night and day, the mean temperature of the air being about 90° till the 22nd, at 5 o'clock, P. M. At 5, the dew point was 76°, as it had been for 4 days before; at 20 minutes after 5, the dew point was 70°; at 30 minutes after 5 it was 67°, and at 6 o'clock, it had fallen to 62°—that is, 14 degrees in one hour.

During all this time there was a great appearance of rain in the north—vivid lightning, thunder audible, and a strong wind blowing towards the cloud; and the temperature sunk 12 degrees. At 45 minutes after six, the wind had nearly ceased; but it did not begin to rain until 9, and rained but very little; but as I understood the next day, it had rained very hard between 5 and 6 within a few miles of the city—the barometer sunk $\frac{5}{100}$ of an inch, while the wind was blowing, but rose again when it became calm. The next morning the dew point had risen 9 degrees at 6 o'clock, and at 2, P. M. one degree more, being then within 4 degrees of its previous state.

It would not readily occur to any philosopher, *á priori*, that the dew point would fall just previous to the commencement of rain, or while it is raining in the neighbourhood; but after the fact is known, it is easily explained, on the principle first, I believe, demonstrated by Dalton, and afterwards discussed at large by Daniell—that aqueous vapour forms an atmosphere independent of the atmospheric air, and that these two fluids press only on particles of their own kind, and not on each other; consequently, as soon as it begins to rain over a small portion of country, as it often does in a summer

shower, the equilibrium of the vaporic atmosphere is disturbed, a partial vacuum of vapour is formed over the region where it is raining, and the vapour from surrounding regions rushes towards the cloud where the pressure is less, diminishing the tension of the vapour in the regions around the cloud, and thus lowering the dew point. How so rapid a depression of the thermometer took place, I am not prepared to explain, but the wind towards the cloud was no doubt produced by the impulse of the aqueous vapour against the particles of atmospheric air. The only objection occurring to me which can be brought against this explanation, is, that the wind is known to blow in all directions from a falling shower, just at the borders of the shower. But this does not invalidate the explanation given above; for this effect is produced by the pressure of the drops of rain, which may be considered as exerting their whole force of gravity on the air beneath them, as soon as they cease to accelerate in their descent towards the surface of the earth; but the wind thus produced is known to extend not far beyond the skirts of the shower, and, of course, at the distance of two or three miles it may yield to the more extensive influence of the cause assigned above.

My object, however, at present being not to assign causes for phenomena, but to induce the Institute to use their influence to cause them to be observed and recorded, I proceed to mention another subject which I hope will engage the particular attention of all those who may hereafter keep a meteorological journal. That is, the evaporating point. By the evaporating point I mean the point to which the thermometer will sink by being surrounded by wet paper.

I some time ago instituted a course of observations on this subject, constantly comparing the evaporating point with the dew point, principally with a view to ascertain if any law could be established, by which the dew point could be known by having the distance of the evaporating point below the temperature of the air. In the first part of these experiments I took it for granted, as stated by Mr. Leslie, that the evaporating point is the same whether the thermometer is at rest in still air, or moved with rapid motion; but I have ascertained, by not less than fifty observations, made with a view to decide this one point, that this is not the fact; for the thermometer, covered with wet paper, invariably stands lower when moved rapidly, than when permitted to remain at rest in still air; sometimes to the amount of four degrees, and this too when the surrounding solid substances are known to be of the same temperature as the air, so that the thermometer could not be affected by radiation. The reason assigned by Mr. Leslie is so plausible that nothing but experiment could have led me to suspect its fallacy. He says that the motion produces a more rapid evaporation, and, of course, more cold, yet the latter effect is exactly neutralized by the warm air coming in contact with the thermometer. I have not yet been able to ascertain the law desired; but that such a law exists, I have no doubt—and if it could be ascertained, the trouble of obtaining the dew point would be entirely avoided; for the evaporating point can always be obtained with as much ease as the temperature of the air. The simplest method which I have been able to think of, to obtain

the evaporating point, is to take an earthen pot unglazed, which I cause to be made for the purpose, and keep it filled with water, either where the air is still, as in a room, or where it is in motion, as you choose. The surface of the pot being constantly wet, the water within will always give you the evaporating point at any moment you may wish to make your observation. This much my observations will warrant me to say on this subject—that in high temperatures in summer, the evaporating point is nearer the dew point than the temperature of the air; and in low temperatures in winter, it is nearer the temperature of the air than to the dew point; consequently, there is some intermediate point where it stands half way between those two temperatures. Perhaps, also, the ratio may depend on the distance of the dew point from the temperature of the air. It would appear, that when the dew point is very far below the temperature of the air, the evaporating point recedes from the temperature of the air, and approaches the dew point.

By using the earthen pot to obtain the evaporating point, another very important inquiry may be answered without any other trouble than measuring the water used in replenishing the pot; i. e. how much water is evaporated from a humid surface in a given time?

Another subject which is at this moment exciting considerable interest among the philosophers of Europe, is, to ascertain the difference of temperature in the shade and in the sun, both with the bulb of the thermometer naked, and with one covered with black silk. Mr. Daniell thinks there is a much greater difference in high latitudes than in low. In Philadelphia, I have frequently found the naked thermometer rise forty degrees, and once fifty-six, above the temperature of the air, while the one covered with black was generally twelve degrees higher. Mr. Daniell also thinks that in high latitudes radiation after sun set cools the surface of the ground much more than in low latitudes. In this latitude, I have seldom found the temperature of the grass more than eight degrees below the temperature of the air. Whereas, Mr. Wells, who wrote the beautiful little essay on dew, says he has seen it as low as sixteen degrees below the temperature of the air. This would allow frost to occur in low situations when the temperature of the air during the night would not be below forty-seven degrees. Whereas, here, frost can hardly occur unless the temperature of the air falls below forty.

Capt. Scoresby mentions, as a strange and unaccountable phenomenon, that he has frequently observed, when sailing in high latitudes, the surface of the sea begin to be covered with thin ice, immediately after sunset, while the temperature of the air was still several degrees above the freezing point. When he called it unaccountable, he probably did not think of the principle of radiation. In Peru, where they have such heavy dews every night, the power of radiation must be very great, or, if not, the dew point must be but little below the temperature of the air during the day. Some traveller, I do not recollect his name, says he has seen frost in Africa in the torrid zone. Now I do not think this at all incredible. For the temperature in those regions must fall as far below the *mean* in the night, as it rises above the mean in the day. The mean tem-

perature of the torrid zone is about 84°, and as loose dry sand is a very bad conductor, and a very good absorber and radiater of caloric, the surface of those wide extended deserts of sand in calm weather may easily be conceived to become fifty or sixty degrees above the mean during the day, and fall as far below it during the night, which would bring it down to the freezing point.

If farmers were acquainted with this one principle of radiation, they would avoid many evils to which they are now exposed. Who would plant an orchard in a hollow, who knew that cold air accumulates in hollows at night by running down the slopes leading to it, in contact with the surface of the ground cooled by radiation?

The time of taking the hygrometric observations is not important; it is not so, however, with the barometer. This instrument has four diurnal fluctuations. Just before sunrise, when the air is the coldest, and about two o'clock, when the air is the warmest, and, of course, neither contracting nor expanding by change of temperature, the barometer stands at its mean height; but sometime between sunrise and the hottest part of the day, when the air is expanding most rapidly by increasing heat, the barometer will stand at its greatest diurnal elevation, and some time after the hottest part of the day, when the air is suffering the most rapid contraction from cooling, the barometer will stand at its greatest diurnal depression. In the torrid zone, the point of greatest elevation is found by observation to be between nine or ten, A. M. and that of greatest depression, between five and six, P. M.* Now as it would be very desirable that two observations should be taken every day, I would earnestly recommend that between nine and ten in the morning, and five and six in the afternoon, be the time of taking observations—and if any observer wishes to take a third observation, or if any should be unwilling to take more than one per day, let two o'clock, P. M. be the hour.

I have now mentioned the most important parts of a meteorological journal, none of which can be omitted without materially diminishing its utility.

Those observers who have self-registering thermometers, will of course note the greatest cold and greatest heat of each day. The course and strength of the wind must not be forgotten; and those who have the means will mention the quantity of rain each month—and those who have the porous earthen pot, will note the evaporation.

If what has been said should induce even one faithful observer to record the dew point alone for one year, I shall consider myself amply rewarded for my trouble in making this communication.

For the sake of those who may not have access to books, and who may be curious on this subject, I have copied from Turner's Chemistry the following table, from which it will appear what proportion of the atmosphere in weight is vapour when the dew point is at the different temperatures from 32 to 80. For example, when the dew point is at 32, the pressure of the vapour alone is $\frac{3}{16}$ of an inch of mercury—that is, $\frac{1}{150}$ of the whole if the barometer stands at 30.

* For a full explanation of this diurnal variation, see this Journal, vol. 1.

inches. And if the dew point should rise to 80 degrees of Fah. which I believe it never does, for I have never seen it above 76; then would the pressure of the vapour alone be equal to one inch of mercury, that is, one-thirtieth of the whole atmospheric pressure.

Temperature of dew point.	Weight of vapour inches.	Temperature of dew point.	Weight of vapour inches.
32	0.200	57	474
33	207	58	490
34	214	59	507
35	221	60	524
36	229	61	542
37	237	62	560
38	245	63	578
39	254	64	597
40	263	65	616
41	273	66	636
42	283	67	655
43	294	68	676
44	305	69	698
45	316	70	721
46	328	71	745
47	339	72	770
48	351	73	796
49	363	74	823
50	373	75	854
51	388	76	880
52	401	77	910
53	415	78	940
54	429	79	971
55	443	80	1.000
56	458		

A journal kept on the plan here recommended, during the month of April, will be given in the next number of this journal.

JAMES P. ESPY.

Philadelphia, March 31, 1831.

On the Strength of Pine and Spruce Timber.

A GREAT portion of the annexed article, appeared in the last number of the American Journal of Science and Arts; it has been, at the request of the committee of publication, revised by the author. The note with which the article is now concluded, has been added, and the value of the table of results in page 232, increased by an extension of the calculations contained in the last column, and by the addition of some practical inferences drawn therefrom. [COM. PUB.

An account of some experiments made by order of Col. Totten, at Fort Adams, Newport, R. I., to ascertain the relative stiffness and strength of the following kinds of timber, viz: White Pine, *(Pinus strobus,)* Spruce, *(Abies nigra,)* and Southern Pine, *(Pinus australis,)* also called *(Long leaved Pine.*)—Communicated by* Lt. T. S. Brown, of the corps of Engineers.

The white pine and spruce were obtained from the eastern part of New England, and the southern pine from North Carolina. The specimens, which were well seasoned, were carefully selected, and were quite free from splits and knots. Three pieces of each kind of wood were taken, each piece being 9.389 feet in length, 2.75 inches in breadth, and 5.5 inches in depth. The distance between the points of support of the pieces under trial, was 7.1 feet. From one end of the beam, one point of support was 0.229 of a foot, or 2.75 inches distant, of course the other bearing point was 2.06 feet from the other end. All the above dimensions were chosen from their being proportional to those which will be actually required in the case to which these experiments refer. The load was applied by means of a strong platform, suspended from the beam, midway between the points of support. Bricks which had previously been accurately weighed, were used as weights. The deflections were measured by means of an index attached to the centre of the beam, and a scale so supported as to be independent of the rest of the system. The scale was isolated to avoid any irregular motions that might take place in consequence of the great weights it was necessary to employ; the supports, however, were so securely braced that no motions of the kind were observed. The scale was divided into parts, each of which corresponded to a deflection in the beam of 1-40th of an inch for one foot in length; as the distance between the points of support was 7.1 feet, it is easily seen that the length of one of these dimensions was 0.177 of an inch.

This deflection of 1-40th of an inch to one foot, was chosen as the unit of the scale, in consequence of its having been laid down by practical writers on the subject, as the greatest deflection of floor beams or joists, that should be allowed in practice.†

The bricks were slowly and carefully placed upon the platform by two assistants, who kept account of the number in an audible voice. As the beam was gradually bent by the increasing load, the moment when the index pointed to one of the divisions on the scale could be easily observed, at the same time the men, by their counting, gave information of the number of bricks on the platform, which being recorded opposite the deflection indicated by the scale, gave the weight producing that deflection. The men going steadily on, soon brought

* It is proper to remark, that although there is no reason to doubt that the spruce used was *Abies nigra*, and that the southern pine was *Pinus australis*, yet it obviously may be very difficult to establish with certainty the botanical name of a kind of wood seen only in the form of *timber*. In the present instance, an attentive consideration of all the circumstances, has given great confidence that the names adopted above are correct, yet those familiar with the subject will at once perceive that in certain cases, the timber of *Abies alba*, might easily be taken for that of *Abies nigra*, and that it might also be difficult to decide between *Pinus mitis* and *Pinus australis*.

† See Tredgold's Carpentry, p. 30 to 46, and Franklin Journal, vol 3.

the index down to another division, when the number of bricks was again recorded, and so on until the deflection was as great as it was proposed to make it, or until the beam was broken; in either case the load was immediately removed from the platform, a new specimen substituted, the index re-adjusted to the zero of the scale, and the same operations repeated. By this method the number of useful observations during each trial, was greatly augmented without causing any additional trouble.

From the foregoing description, it will be seen that the loads were not allowed much time to act upon the beams, from which it follows that the weights producing the different deflections are rather overrated. With regard to the object for which these trials were instituted, this was a matter of no importance, as it could not affect the relation between the different kinds of wood, and upon making some experiments to ascertain the amount of error, it was found so small that it might with safety be neglected.

In the first trial, for instance, (Table [A,] specimen, No. 1,) the load of 2662 pounds, which produced a deflection of 4-40ths of an inch to a foot, instead of being immediately removed, was allowed to remain suspended for two hours and forty minutes, when it was found that the centre of the beam had sunk only 0.077 of an inch.

The foregoing observations, with a few explanatory remarks, will, it is hoped, render the following tables intelligible.

TABLE (A.) *Detailed Statement of Experiments to determine the relative Stiffness of White Pine, Spruce and Southern Pine.*

Deflection in parts of an inch to one foot.	Whole deflection in inches.	White Pine.		Spruce.		Southern Pine.		REMARKS.
		No. of specimen.	Weight in pounds, producing the deflection.	No. of specimen.	Weight in pounds, producing the deflection.	No. of specimen.	Weight in pounds, producing the deflection.	
1/320	0.022	1	111	4	126	7	217	Whole length of specimens in feet, 9.389 Bearing length in feet, 7.1 Breadth in inches, 2.75 Depth in inches, 5.5
1/40	0.177	"	836	"	737	"	1187	
2/40	0.355	"	1516	"	1295	"	2252	
3/40	0.532	"	2125	"	1960	"	3266	
4/40	0.710	"	2662	"	2683	"	4078	
1/320	0.022	2	126	5	131	8	222	In these trials, each specimen, upon being relieved of the load producing the greatest deflection, sprung back by the elasticity of the wood, until the centre came within about 0.046 inches of being as high as it was before the experiment commenced. This deflection of 0.046 inches, would have been still further reduced had more time been allowed; the elasticity of the wood, therefore, remained entire.
1/40	0.177	"	715	"	973	"	1195	
2/40	0.355	"	1448	"	1729	"	2270	
3/40	0.532	"	2074	"	2464	"	3274	
4/40	0.710	"	2708	"	3119	"	4259	
1/320	0.022	3	126	6	146	9	217	
1/40	0.177	"	781	"	968	"	1145	
2/40	0.355	"	1491	"	1815	"	2134	
3/40	0.532	"	2125	"	2449	"	3037	
4/40	0.710	"	2733	"	3098	"	3996	

TABLE (B.) *Being a condensation of the results given in Table* (A,) *with other facts connected therewith.*

Kind of Wood.	Specific gravity.	Weight of a cubic foot.	Deflection in parts of an inch to one foot.	Whole deflection in inches.	Weight in pounds producing deflection.	Differences for each division on the scale of deflections.	Constant quantity (a) in the expression for stiffness, $\frac{B \times D^3}{a \times L^3} = W$.
White Pine.	.455	28.43	$\frac{1}{320}$	0.022	121		
			$\frac{1}{40}$	0.177	777	777	a=0.0116811
			$\frac{2}{40}$	0.355	1485	708	a=0.0061119
			$\frac{3}{40}$	0.532	2108	623	a=0.0043056
			$\frac{4}{40}$	0.710	2701	593	a=0.0033603
Spruce.	.490	30.63	$\frac{1}{320}$	0.022	134		
			$\frac{1}{40}$	0.177	892	892	a=0.0101751
			$\frac{2}{40}$	0.355	1613	721	a=0.0056269
			$\frac{3}{40}$	0.532	2291	678	a=0.0039617
			$\frac{4}{40}$	0.710	2966	675	a=0.0030601
Southern Pine.	.872	54.50	$\frac{1}{320}$	0.022	218		
			$\frac{1}{40}$	0.177	1175	1175	a=0.0077244
			$\frac{2}{40}$	0.355	2218	1043	a=0.0040921
			$\frac{3}{40}$	0.532	3192	974	a=0.0028434
			$\frac{4}{40}$	0.710	4111	919	a=0.0022078
a	*b*	*c*	*d*	*e*	*f*	*g*	*h*

REMARKS.

In the expression for stiffness, $\frac{B \times D^3}{a \times L^3} = W$, (col. *h*,)

(B) represents the breadth in inches,
(D) the depth in inches,
(L) the bearing-length in feet, and
(W) the weight.

The constant number (a) has been calculated for the different deflections from one-fortieth of an inch for one foot to four-fortieths, inclusive, but in practice the deflection should, generally, not be allowed to exceed one-fortieth of an inch for each foot in length. In works on this subject, it is laid down as a rule, that if we wish to give a deflection double, treble, or quadruple, the ordinary deflection of one-fortieth of an inch to one foot, we must divide the constant (a,) determined for a deflection of one-fortieth of an inch, by 2, 3, or 4, for the new constant required. We are enabled by this table to make a comparison between the results thus obtained, and those arising from direct experiment. For instance: for White Pine, the constant number for one-fortieth of an inch deflection, is 0.0116811, which divided by 2 for a deflection of two-fortieths, gives 0.0058405, whereas in this table, the constant for a deflection of two-fortieths of an inch is 0.0061119. The difference is 0.0002714; with a greater deflection, the difference between the result of the two methods would be greater.

TABLE (C.) *Experiments to ascertain the circumstances of fracture, giving the aggregate of the results for each kind of wood.*

Kind of Wood.	Deflection in parts of an inch to one foot.	Whole deflection in inches.	Deflection at moment of FRACTURE.	Whole deflection in inches at moment of FRACTURE.	Weight in pounds producing deflection.	Weight producing FRACTURE.	Differences for each division on the scale of deflections.	Comparative strength of white pine, spruce and southern pine, white pine being unit.	Value of the constant quantity (c) in the expression for *strength*, $\frac{B \times D^2 \times c}{L} = W$.
White Pine.	$\frac{4}{40}$	0.710			2656		664		
	$\frac{5}{40}$	0.887			3217		561		
	$\frac{6}{40}$	1.065			3745		528		
	$\frac{7}{40}$	1.242			4062		317		
	$\frac{8}{40}$	1.420			4266		204		
	$\frac{9}{40}$	1.597			4390		124		
	$\frac{10}{40}$	1.775			4560		170		
	$\frac{11}{40}$	1.952			4664		104		
	$\frac{12}{40}$	2.130			4775		111		
	$\frac{13}{40}$	2.307			4833		58		
	$\frac{14}{40}$	2.485			4893		60		
			$\frac{16}{40}$	2.840		5189		1.000	$c = 443$
Spruce.	$\frac{4}{40}$	0.710			2806		701		
	$\frac{5}{40}$	0.887			3505		699		
	$\frac{6}{40}$	1.065			3955		450		
	$\frac{7}{40}$	1.242			4443		488		
	$\frac{8}{40}$	1.420			4705		262		
	$\frac{9}{40}$	1.597			4877		172		
	$\frac{10}{40}$	1.775			5051		174		
	$\frac{11}{40}$	1.952			5185		134		
	$\frac{12}{40}$	2.130			5324		139		
	$\frac{13}{40}$	2.307			5441		117		
			$\frac{15}{40}$	2.662		5646		1.101	$c = 482$
Southern Pine.	$\frac{4}{40}$	0.710			3698		924		
	$\frac{5}{40}$	0.887			4611		913		
	$\frac{6}{40}$	1.065			5487		876		
	$\frac{7}{40}$	1.242			6268		781		
	$\frac{8}{40}$	1.420			7049		781		
	$\frac{9}{40}$	1.597			7593		544		
	$\frac{10}{40}$	1.775			8033		440		
	$\frac{11}{40}$	1.952			8429		396		
	$\frac{12}{40}$	2.130			8578		149		
			$\frac{14}{40}$	2.485		9237		1.780	$c = 788$
	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*

Remark on the foregoing Table.

In the expression for strength $\frac{B \times D^2 \times c}{L} = W$, column *i*, the letters B, D, L, and W, have the same signification as in Table (B.) (See note at the conclusion of this article, page 236.)

TABLE (D.) *Relative stiffness of White Pine, Spruce and Southern Pine, at different deflections, White Pine at each particular deflection being taken as the unit.*

	RATIOS OF STIFFNESS.		
Deflection in parts of an inch to one foot.	White Pine.	Spruce.	Southern Pine.
$\frac{1}{320}$	1.	1.107	1.801
$\frac{1}{40}$	1.	1.148	1.512
$\frac{2}{40}$	1.	1.086	1.493
$\frac{3}{40}$	1.	1.087	1.514
$\frac{4}{40}$	1.	1.098	1.522
$\frac{5}{40}$	1.	1.078	1.532
$\frac{6}{40}$	1.	1.056	1.465
$\frac{7}{40}$	1.	1.096	1.543
$\frac{8}{40}$	1.	1.102	1.652
$\frac{9}{40}$	1.	1.110	1.729
$\frac{10}{40}$	1.	1.107	1.761
$\frac{11}{40}$	1.	1.111	1.807

Observations on the foregoing Tables.

Although table (B) embodies all the information given in table (A,) it is nevertheless thought of some importance to present the results actually obtained in the experiments, the mind is thereby better satisfied, and in this instance the general agreement of those results will tend to inspire confidence. Table (C) contains the average of the results of the original experiments under that head, which were found to harmonize with each other in the same general manner as those of table (A.) It may be remarked with reference to the weight producing fracture, that the results given in table (C) are slightly overrated, in consequence of the small time occupied in making the experiments; this, however, is no practical disadvantage, as in calculating the strength of timber from algebraical formulæ, large allowance must always be made to provide against accidental defects.

It was observed in all these experiments, that the failures of the wood began at the top. The upper fibres, for rather less than half the depth of the beam, were gradually crushed and broken off in the bending of the specimen, and at last when no more weight could be supported, a fracture suddenly took place, the lower fibres being drawn asunder. It seemed that the bending took place more in consequence of the crushing of the upper fibres than the extension of

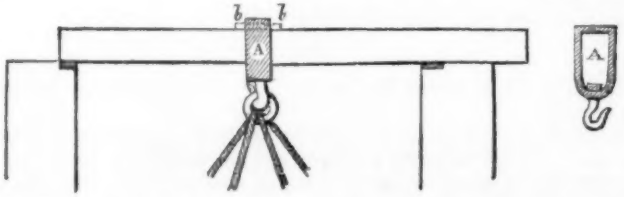
the lower ones. The fractures were not sufficiently regular to permit any comparison to be drawn as to the relative number of fibres crushed and drawn asunder in the different kinds of wood.

The results in columns (*g*) of tables (B) and (C,) indicate the weights which were required to bend the specimens through an additional division on the scale of deflections. If the deflections were always as the weights producing them, it is evident that all the differences in columns (*g*,) would, for the same kind of wood, be equal. It is easily seen, however, as might have been anticipated, that after having passed with considerable regularity through the first two or three divisions, the deflections begin to increase in a much greater ratio than the weights. From this cause it is very important that in experiments on the stiffness of timber, small deflections only should be tried, and that those deflections should be accurately measured.

It may be seen that the weights producing deflections of 4-40ths of an inch to one foot are less in table (C) than in table (B,) the reason for which is, that the stiffness of the wood was diminished by the first trials.

A circumstance of a practical nature connected with these experiments, deserves to be noticed, as it may possibly have modified the results in a slight degree. It was necessary in suspending the load from the beam, to adopt some precaution to prevent the iron band connected with the platform, from cutting into the wood, and thereby crippling the timber. The annexed sketch will indicate more clearly than any description, the means that were employed.

Fig. 1. Fig. 2.



(A,) Figs. (1) and (2) is a strong iron collar, three inches wide and half an inch thick, embracing the specimen under trial, from which, by means of the hook below, the platform containing the load was suspended: (*b*) represents a bar of iron 2.75 inches wide, six inches long, and half an inch thick, resting upon the wood underneath the collar.

It is therefore evident that the load was not applied precisely at the centre point, but upon a surface six inches long, the centre of which corresponded with the centre of the bearing length.

In every instance when the beam was broken, the fracture took place at one end of the bar (*b*), and therefore at the distance of three inches from the true centre.

In the trials relating to stiffness, tables (A) and (B,) it is not supposed that this bar modified the results in any appreciable degree, that is to say, the results given in these tables may, without any sensible error, be considered as having been obtained by applying the

weight precisely at the centre. The case is different, however, with the results given in table (C); but since the error, whatever it may be, (and that it must be small is evident,) does not affect the comparison of the woods, it is of no consequence as to the particular object had in view.

Some of the *general* inferences to be drawn from the foregoing experiments, are:—

1st. That within certain limits, which extend much further than it is proper in practice to suffer wood to bend, the deflections are very nearly as the weights producing them; see table (B,) column (*g*.)

2nd. When we have a given weight to sustain, so that the deflections shall not exceed 1-40 of an inch to one foot, other circumstances being equal, ten beams of southern pine are equivalent, nearly, to thirteen of spruce or to fifteen of white pine. When the deflections to which the timber is exposed are very much less than 1-40th of an inch to one foot, or when we merely wish to guard against fracture, the disproportion between southern pine and the other woods, is much greater; see 2nd and 1st lines, table (D) and column (*h*,) table (C.) It was to obtain the results given in this paragraph, that these experiments were instituted. [*Silliman's Journal.*

Note by the Author.

For the benefit of those who do not understand the use of algebraic formulæ, it may not be amiss to translate into ordinary language the expressions for stiffness and for strength found in tables (B) and (C.)

The expression for stiffness $\frac{B \times D^3}{a. \times L^2} = W$, (Table B,) amounts, in common language, to the following

Rule.

1. Multiply the breadth, (in inches,) three times by the depth, (in inches.)

2. Multiply the constant number (*a*) twice by the bearing-length (in feet.) This constant number (*a*) is to be found in Table (B,) opposite the name of the kind of wood, and particular deflection desired.

3. Divide the result of the first operation by that of the second, and the quotient is the weight, in pounds, which may be placed on the centre of the beam, so that its deflection shall not exceed the deflection desired.

Example 1.—Required to find the weight which may be placed on the centre of a white pine beam, the distance between the supports near its ends being 20 feet, its breadth 6 inches, and its depth 12 inches, so that the deflection shall not exceed one-fortieth of an inch for every foot of its length, or, in other words, so that the whole depression at its centre shall not exceed twenty-fortieths, or half an inch.

In Table (B) we find the number (*a*) for a deflection of one-fortieth of an inch in White Pine to be 0.0116811. Then, 6 inches (the breadth,) multiplied three times by 12 inches, (the depth,) gives - - - - - 10368 (1st.)

0.0116811 multiplied twice by 20, (the length in feet,) gives - - - - 4.672 (2nd.)

Divide the first by the second, and we have - 2219 for the weight, in pounds, which may be placed at the centre of the beam.

Example 2.—Suppose that a stick of Southern Pine, 12 inches deep, and having a bearing-length of 15 feet, is required to support at the centre a weight of 16891 pounds, how broad must it be, so that the deflection shall not exceed two-fortieths, or one-twentieth of an inch to a foot; that is, so that the centre shall not be depressed more than fifteen-twentieths, or three-fourths of an inch.

In this case, as we wish to obtain the breadth of the beam, we must multiply the weight, in pounds, twice by the length in feet, and that product by the number (*a*) and divide the result by the depth, (in inches,) multiplied twice by itself. We find from Table (B,) the number (*a*) opposite the deflection of two-fortieths of an inch in Southern pine, to be 0.0040921. Then 16891 multiplied twice by 15, and by 0.0040921, gives - - 15552 (1st.)
12, the depth in inches, multiplied twice by itself, gives - - - - - 1728 (2nd.)
The first divided by the second, gives - 9 inches.

The beam must then be 9 inches broad to fulfil the condition required.

The expression for the strength of timber $\frac{B. \times D^2. \times c}{L} = W$, (Table C,) which expresses the resistance to fracture, may be translated into the following

Rule.

Multiply the breadth, (in inches,) twice by the depth, (in inches,) and the product by the constant number (*c*) for that particular kind of wood. The result thus obtained divided by the bearing-length, (in feet,) gives the weight, in pounds, which will just break the beam.

Example. Required to find the weight which a beam of Southern Pine, 20 feet long between the supports, 10 inches broad, and 12 inches deep, will support at the centre, without breaking.

In this case the number (*c*) is 788 (Table C, col. *i.*) Then 10 inches, (the breadth,) multiplied twice by 12 inches, (the depth,) and the last product by 788 (*c*) gives - 1134720 (1st.)
Divide this by 20, (bearing-length in feet,) and we have - - - - 56736 pounds, the weight required to break the timber.

It must be borne in mind that these results are true only for the finest qualities of well seasoned timber. Green timber is neither as stiff nor as strong as that which has been seasoned, and deductions must be made to guard against defects.

These illustrations will fully exemplify the value, to practical men, of accurate experiments upon the stiffness and strength of timber. "To know the resistance which a piece of timber offers to any force tending to change its form, is one of the most important species of knowledge that a carpenter has to acquire; and to be able to judge of the degree of resistance from observation only, even in common cases, requires nothing less than the practice of a life devoted wholly

to carpentry. Besides it is a species of knowledge that is confined to the person who has obtained it, and dies with him. It is a feeling of fitness that cannot be communicated, nor yet described; nevertheless it is a feeling that every thinking, practical man is sensible he possesses. I am far from having a wish to banish the nice observation that gives birth to this feeling; because it is more desirable that it should be encouraged than suppressed: but there are cases where it fails; that is, when the magnitude of the object is beyond the range of ordinary practice; and when new combinations are attempted. In such cases the laws of the resistance of solids should be referred to, even by the expert practical man; and he will be better able to judge of their correctness if he finds them, in common cases, to give results that agree with those he has drawn from practice."* In Tredgold's Carpentry, and other similar works, may be found the constant numbers (*a*) and (*c*) for nearly all the kinds of wood useful in the arts; but besides that these numbers are in many instances calculated from insufficient experiments, most of the specimens used in the trials were of European growth, and, of course, the results obtained are inapplicable to American timber, though bearing the same name. It is much to be desired that numerous and accurate experiments be made, in this country, by those having the requisite zeal and opportunities; our architects will then know with certainty the qualities of the different kinds of wood they are using, and instead of working at hazard and in the dark, as they now too often do, they will be guided by the sure light of practical science to certain and definite results. If these experiments contribute, ever so little, to the attainment of so important a result, the object of their publication will be fully accomplished.

On the Straight Edge.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Mr. Editor,—The difficulty and expense of making Straight Edges of considerable length, render any improvement in these indispensable tools a desideratum. The usual mode taken to make them accurate, is to secure together three thin bars of steel, and file them together to a uniform breadth, or as nearly so as practicable; then to separate them, and compare their edges respectively with each other: if when the ends are reversed and the edges again compared, they should correspond, they may be considered, for all practicable purposes, perfect.

This method being tedious and expensive, good straight edges of more than three or four feet in length are rarely to be met with, and highly prized when obtained. When they are required of greater length, a serious difficulty occurs in their use. The slightest lateral deviation from a straight line will, of course, affect the accuracy of the instrument; consequently, the bar must be made so inflexible that it will not bend when inclined to the side, and, of course, becomes a cumbrous tool. To remedy the last difficulty, an ingenious mechanic of this city constructed one of a cylindrical form, of

* Tredgold.

iron cast hollow, about two inches diameter, and turned so thin that its weight was not objectionable, while its form rendered it inflexible to a considerable length, and in use was found quite as convenient as the flat straight edge. The cylinder being first turned in a slide lathe, and then ground with emery in a lead cap made to fit the circle, produced an instrument of great accuracy, at trifling expense.

We have been led to these remarks by observing at a workshop in this city, a straight edge so simple and cheap, that we almost doubted its novelty, though we confess such a one never before came under our notice.* It was made of steel harpsichord wire, stretched upon the edge of a board or frame and kept tight by screws—set screws were placed at each end which passed to the under side of the wire, and suffered it to touch the work or not, at the option of the workman.

The instrument we saw was twelve feet in length, and was stretched to the whole extent of the lathe shears which were finishing by it. The wire being too fine to exhibit the inequalities of the work to the eye, the operator set the points of the screws so far beneath the wire that it should only touch at the more prominent places, and then on passing along the work, discovered, by depressing the wire, where it touched and where it did not. The trouble attending the use of this instrument made it more convenient to use a wooden straight edge for roughing down the work, but its great accuracy made it very valuable in finishing.

We have often seen fine thread fastened to a wooden bow for the same purpose, but such a tool can only be depended on when held to the side of the work, obliging the operator to turn it over whenever he wanted to examine his progress, (an operation inconvenient when working a heavy casting,) because the thread curved by its own weight. No such difficulty is experienced in using the above, as its tenacity is so great, that it will bear a strain sufficient to keep it perfectly straight. M.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN DECEMBER, 1830.

With Remarks and Exemplifications, by the Editor.

1. For an improved *Grist Mill*, called the 'Pressure or Weighted Grist Mill;' John Ambler, jr. and David C. Ambler, Berlin, Chenango county, New York, December 6.

This is a Grist Mill intended to operate with small stones; in its general construction it resembles some of the other portable grist mills, for which patents have been obtained. The particular differ-

* It is not new, but has been used for testing the straightness of gun barrels. —EDITOR.

ence between it and others, could not be pointed out without a minute investigation, in which few persons would feel interested. We give the claim, which is as follows.

"The parts to which we lay claim as original, is the weighting of the upper stone with heavy articles, as iron, lead, stone, &c. The manner in which the safety rod, or damsel, is made, which allows it to be oiled at the top, and its resting on the balance rim in such a manner as not to interfere with the balancing of the upper stone; and the using its damsel as a protecting rod, to protect the upper stone from raising farther than it is raised by the bridge tree."

We have seen samples of the flour manufactured by it, which appeared to be equal to that made in the larger mills, although the stones used were not more than 24 inches in diameter. Whether this arose from the mill being more skilfully made and managed, or from any inherent superiority in its structure, we are unable to say.

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2. For a machine for *Making Window Sashes;* Charles Thompson, Poughkeepsie, Dutchess county, New York, December 6.

It is proposed to combine together in one frame, 1st, a machine for sawing off and slitting the boards; 2nd, a machine for planing, striking, and rebating; 3d, a machine for sawing the tenons; 4th, a machine for mortising; 5th, a machine for sawing munnions and dovetails; 6th, a coping plane; 7th, a grooving machine.

The sawing is to be effected by circular saws. The planes are to be moved backward and forward by a crank motion, and the machinery generally is to be driven by drums and straps. "The improvements claimed, are the before described machines, when combined, for making window sashes."

In the separate machines there is little or no novelty, and judging by the claim, it would appear that the patentee is aware of this, as he does not claim any of the particular parts of either of them. There are already machines in successful operation for the same purpose with the foregoing; and although the present patentee might defend the particular combination described, provided neither of the individual machines interfere with existing claims, a patent, based upon the mere arrangement of parts, without a claim to actual novelty in any of the individual parts, does not appear to us to stand very securely; as an ingenious workman can, in most cases, very readily devise another arrangement, which shall be equally efficient, and have an equal claim to novelty.

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3. For a machine for *Thrashing and Winnowing Wheat* and other small grain; Thomas Burrall, Geneva, Ontario county, New York, December 6.

The thrashing is to be effected in the ordinary way, by means of a cylinder and hollow segment. There are to be cast iron side plates to sustain the cylinder and segment. A rake, screen, and fan wheel, are used in the winnowing or cleaning.

The most convenient mode of driving this machinery, we are told, is by horses, or oxen, upon an inclined wheel. This wheel the patentee says he has "improved by a new mode of graduating and governing its motion." This is effected, if we understand the description, by altering the inclination of the wheel, or the position of the animals. But of this part there is no drawing, and the explanation is not very clear. The claim is to "the *cast iron side plates* for the purpose above set forth. The arrangement and combination of the rake, racks, and fan, for separating the grain from the straw and chaff, in the manner described, and the swing bar for governing the inclined wheel by which the power is applied."

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4. For a machine for *Washing Clothes;* Alvan Foote, Granville, Licking county, Ohio, December 7.

The cloths are to be put into a revolving barrel, closed by a door. The barrel is to be turned by a crank in the ordinary way. The gudgeon upon which it turns at the opposite end is hollow, for the admission of steam. A boiler, furnished with a safety valve, is to supply the steam through a tube passing into the hollow gudgeon. We are not told any thing about a stuffing box at the junction of the two, to prevent the escape of the steam, *but this is a thing of course.*

"What I claim as my invention, is the mode of introducing the steam into the cylinder, through the gudgeon and pipe, as before described, when applied to machines for washing clothes."

In addition to the calamitous explosions on board of steam boats, we may shortly hear of the blowing up of washing machines, and the maiming of the poor old women who are to become engineers. The main security in this machinery, will be the difficulty of rendering the junctures steam tight; in which case the steam and the washerwoman may escape, uninjuring and uninjured.

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5. For a *Bed Key;* Judson Blake, and Daniel Cushing, Providence, Providence county, Rhode Island, December 14.

This bed key is to be of cast iron or other metal, and is to have two, three, four, or more, arms, each having a socket in it of different sizes, to fit different screw heads. There are five different forms represented, in which the key may be made, and fifty might be given.

"The superior utility of this improvement over the common bed key, consists in its fitting screws of a greater number of sizes, and in its being made of such materials, and in such a manner, as to cost less than the key now in use."

To be able to trace the successive steps by which an inventor of some complex machine arrives at the final result, would, in many cases, be highly interesting, but the task would be one of great difficulty. Although the invention before us, is not one of great complexity, it would still be no easy thing to assign to each of the heads

which have been engaged in maturing the plan, their respective shares of the merit due to them.

Would not a common iron brace, with two or three bits, having sockets of different sizes, answer the purpose intended better than the patented machine? We think it would, and are very sure that it would not interfere with this *new and original discovery*.

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6. For an improvement in the art of heating or warming rooms, dwelling houses, offices, hot houses, churches, or any other public or private building of any description, or size, by means of a machine, apparatus, or implement, which he denominates a "*Portable Steam and Hot Water Stove;*" Thomas Green Fessenden, Attorney at Law, Charlestown, Middlesex county, Massachusetts, December 14.

(See specification.)

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7. For an improvement in machinery *for Sawing Veneers;* Caleb B. Burnap, city of New York, December 14.

This machinery is designed to enable a circular saw of small diameter to saw veneers from wide logs. The circular saw is to be constructed like those commonly used for sawing veneers; that is, it is to have one fair face, and is supported on the opposite side by a shaft running in collars, like a collar and mandril lathe. The saw and its shaft is to be fixed in a vibrating frame, which will carry the saw up and down to the distance required for the width of the log to be cut. The veneer is to be turned off, out of the way of the saw-shaft, in the usual manner. The claim is to "the application of the vibratory motion to one or more circular saws for sawing veneers from a plain surface."

The mode of giving the vibratory motion is by the application of a crank and pitman. This, however, we need not describe, as the particular manner of doing this, which the patentee gives, forms no part of his claim.

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8. For a *Machine for Planting of Corn*, or corn and peas, in the drill form; Reuben Coffey, Burke county, North Carolina, December 14.

This planting machine bears a strong resemblance to many others. The general form of it is somewhat like that of a plough. There is a coulter in front to open a furrow; behind this is a wheel, which runs upon the ground, and has projecting spikes to insure its revolving. The seed is put into a hopper, and is caused to drop into the furrow, in proper quantity, by the action of the wheel. The earth is closed upon the seed, by a scraper, or pins, behind the wheel.

In the principle of the machine there is no novelty. There is no claim made, and to the drawing there are no written references.

9. For a *Portable Machine for conveying Animal Power of any kind to Machinery;* Joseph C. Gentrey, city of Philadelphia, December 14.

This may stand among the many extraordinary patents obtained for things, the novelty of which neither the patentee, or any other person, can point out. A lever, or sweep, to which a horse or other animal is to be attached, is to turn a vertical shaft. Upon this shaft is to be a cog wheel like that commonly employed; the cog wheel is to drive a pinion, which pinion turns a band or strap-wheel, eight feet in diameter. Here we are compelled to end our description, because we have given the whole; and the whole claim is to "the above described machine for conveying power of any kind to machinery."

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10. For an *Improvement in Distilling;* Thos. Gallaher, Liverpool, Perry county, Pennsylvania, December 14.

This is a steam distilling apparatus, the novelty of which must be judged of by those who know what has been already done in this way, after reading the claims of the patentee.

"What I claim as my invention, is the method of having an opening, or openings, passing through the boiler, for causing the fire to return through the boiler before it passes off into the flue, when applied to distilling. I also claim the method before described of causing the steam to return back from the doubler into the heater, and from thence through the mashing tub; and likewise placing the doubler apart from the other parts of the apparatus."

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11. For an improvement in the mode of *Extracting Oil from Cotton Seed;* Gideon Palmer, Montville, New London county, Connecticut, December 14.

"The seed being hulled in the usual way, is ground in an oil mill like flax seed. About three quarts of water are mixed with about 75 pounds of seed. The flour is then put into an iron cylinder and heated over a fire until steam is produced. It is then put into my patented oil press, and the oil extracted.

"The effect of this process is to extract much more oil than in the common mode of pressing the seed with the hull on. The oil cakes are also made much more valuable.

"What I claim as my own invention is the before described mode of extracting oil from cotton seed with the hull off, and not in the usual way with the hull on." "GIDEON PALMER."

By turning to Vol. 3, No. 5, p. 260, it will be seen that on the 21st of January, 1829, Francis Follet, of Petersburg, Virginia, obtained a patent for hulling cotton seed, in order to prepare it for the oil press; and at p. 141 of our last volume, a letter addressed to the patentee, from Gen. Williams, of South Carolina, furnishes much information on the application and utility of this invention. The "mode of extracting oil from cotton seed with the hull off, and not

in the usual way with the hull on," is not now, therefore, a legitimate subject of claim.

We do not suppose that Mr. Palmer means to limit his claim to the pressing of cotton seed in his patented oil press, but that he would consider the Dutch pestle and wedge, as an interference with his right. Neither the moistening or the heating of seeds for the purpose of extracting their oil, are new. The keeping to the particular proportions named, may be so.

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12. For an improvement in the *Press for pressing oil, cotton, tobacco,* and other substances requiring great pressure; Gideon Palmer, Montville, New London county, Connecticut, December 14.

This press is to be operated upon by the gravity of water. At the lower part of the press, a vat, or cistern, is constructed, which is capable of being filled with water. Within this is placed a second cistern filled with water, and of about one-half of the depth of the former. When the outer vessel is filled, the inner one will float within it, and when the water is drawn off from the outer vessel, the inner will tend to descend with its load of water, which in the press described, would amount to nine tons. An upright shaft ascends from the inner cistern, to which it is firmly attached and secured by braces. This shaft operates upon the arms by which the pressure is to be made. The principle of the action of these arms is that of the toggle joint; each arm presses outwards against the sides, or cheeks of the press.

The seed, or other article to be pressed, is placed between boxes, or gripes, at each side. Against these boxes, or gripes, followers are forced by means of the jointed arms, which when the shaft is up, and the press out of action, rise, so as to form an angle with each other, and when in full action stand in the same horizontal line. The upper end of the shaft is in the form of a wedge, with its narrowest end downwards. This wedge stands between the inner ends of the arms, and operates, with their own descent, to force their opsite ends out upon the article to be pressed.

The press boxes, or gripes, between which the seed is to be pressed, "are made of bars of wrought iron, lined with sheet iron, bolted and keyed together at the corners, in such a manner, as to open and shut to receive and discharge their contents with ease and facility."

"What I particularly claim as a new and useful improvement in the oil press is, first. The application of a weight of water to press any substance requiring pressure, in the manner above described. Secondly. The formation of the press boxes, and application of these press boxes afore described to the ordinary screw and lever press. Thirdly. The wedge as applied in the press above described."

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13. For a mode of making or *manufacturing Shoes and Boots,* called the Farmer's double improved boot and shoe sole;

Moses Pennock, Marlborough, Chester county, Pennsylvania, December 14.

(See specification.)

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14. For an improvement in making *Wrought Iron Nails;* G. B. Manley, Canton, Norfolk county, Massachusetts, Dec. 14.

"Take good fibrous iron, and roll it the thickness of the nail required; the bar and the slab should pass through the rolls in the same manner as it is drawn, that the grain or fibre of the iron may be laid one way: then the sheets, or plates, are slit into strips, across the grain, of sufficient width for the length of the nail required; making proper allowance for drawing the edges."

The strips are then to be drawn by hand or strip hammers; and the heading is to be performed with dies, giving to them that shape which wrought nails require.

The claim is to the "drawing the edges of strips, either by hand hammers, or by tilt or trip hammers, or by rolling, which gives the nail the form and properties of the best wrought nails."

To us, who have frequently witnessed the rapidity with which the nailers form wrought nails from rods, it appears improbable that much advantage in point of expedition can be gained by the plan of the present patentee, as after the rolling, each nail must be handled three times, whilst by the ordinary mode once is sufficient.

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15. For an improvement in the *mode of making Spoons;* Archibald Little, Bridgetown, Cumberland county, New Jersey, December 14.

The mode here patented is the employment of the common drop press, and steel dies. The lever or screw press, we are informed, will answer the purpose.

The claim is to "the mode of making spoons in dies, with the apparatus before described for that purpose, instead of the usual mode of hammering, or casting."

A patent for a similar purpose was granted on the 27th of December, to Robert Butcher of Philadelphia; but we believe this latter gentleman intends, principally, to raise spoons out of sheet tin. The specification of his patent will be found in the present number.

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16. For a *Thrashing Machine;* George Jessup, Troy, Rensellaer county, New York, December 14.

The claims are

"The having the thrashing wheel or cylinder, revolve upon points or centres, as contra-distinguished from gudgeons."

"The manner in which the upper fluted roller is made moveable up and down, and in which the necessary degree of pressure of the roller upon the straw is effected."

"And in the horse machine,

"The manner in which the power and motion are communicated from the lever to the thrashing or other machine, to which the same are to be applied."

"The manner in which the motion may be accelerated."

"The manner in which the tension of the rope or band may be increased or lessened."

As these modes and manners do not bring to light any new principle, or combination, we need not describe them.

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17. For a *Water Wheel* for propelling Machinery; James Johnson, Fairbanks, Sullivan county, Indiana, December 14.

We cannot take the trouble to revert to any of the patents which are identical in principle with the present, nor will the readers of this journal require it. Leaves, or buckets, are hinged to arms projecting from the solid hub on the end of a shaft. The buckets are to open and close, like shutters, by the action of the current.

"Your petitioner claims the whole wheel above described to be his invention, the shaft excepted."

The shaft, and even thew ater itself, might be as fairly claimed, as is this whole wheel.

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18. For a *Machine for Propelling Machinery;* Thomas D. Newson, and James C. Shule, Nashville, Davison county, Tennessee, December 14.

The utter worthlessness of this machine will be at once perceived by every machinist, when we say that power is to be gained by means of a pendulum, which pendulum is to be kept in motion by a double rimmed cog wheel, each rim having cogs and intervals alternately; the alternate cogs are to take into a pinion, to keep the pendulum swinging. Those who believe in the possibility of perpetual motion have gone beyond us, and are above our instruction; those who do not, have no need for it on an occasion like the present.

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19. For a *Circular Slide Rest*, to be used in the turning lathe, by which round balls, elliptical balls of any proportionate diameter, convex or concave surfaces, bowls, or segments of a circle may be turned; M. J. Gardner, York, York county, Pennsylvania, December 14.

The parts of this slide rest, are perfectly well delineated and described. The rest revolves upon a circular groove on a firm bed, and chisels of different kinds may be fixed in the upper part of it. The whole is considered as new, no part being claimed. Its application to circles and to segments of circles is apparent, but we do not perceive how it is to be advantageously applied to "elliptical balls."

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20. For an improvement in the *Art of Sawing Timber;* David Stern, Venderburgh county, Indiana, December 14.

This saw mill is to be worked by horse, or other power. The carriage descends upon an inclined plane, and has to mount up hill by means of a tread wheel. The saw runs between fender posts in the usual way. The gearing consists of several wheels and pinions. The description and drawing are extremely imperfect; there is no claim, and nothing worth claiming, as neither in its principle or arrangement, does this machine offer any thing that is new or valuable.

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21. For a *Machine for Cutting Paper;* John Shugert Quincey, Franklin county, Pennsylvania, December 14.

A cutting knife, very similar to that used for cutting dye woods, is fixed upon a bench. To insure its correct movements it works up and down between guides. To increase the power, the lever is made compound; that by which the handle of the knife is worked is attached to the bench by a joint; this lever is connected with the handle of the knife, by a jointed connecting rod. The paper to be cut is held upon the bench by a screw, and the sides of the ream are successively subjected to the action of the knife. The claim is to "the construction and arrangement of the above described machine for cutting paper, but particularly the compound lever and guides."

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22. For an improvement in the *Art of Making and Curing Salted Beef*, and particularly of the description called jerked beef; William A. Tomlinson, city of New York, December 14.

(See specification.)

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23. For an *Economical Oven;* Abel Stowell, Medford, Middlesex county, Massachusetts, December 14.

This is intended as an improvement on the common bake pan. A square box of iron is made, resembling the oven in a common cooking stove, and having a door on one side in the same manner. This box has a bail to it, by which it may be suspended, and has legs that it may stand on the hearth, with fire beneath it. Within the oven there is a moveable shelf dividing it into two parts. On its top there is a ledge, like that on the lid of a bake oven, to retain the fuel placed on it.

"What I claim as my invention, is an improvement on the common baking pan, by making the opening through which the articles to be baked or cooked may be placed within, or withdrawn from the said oven in a lateral situation, and which opening may be closed by a door connected to the oven, instead of the moveable cover as is usual; by which means baking or cooking may be effected in a more economical, cleanly, and expeditious manner, without subjecting the operator to the inconveniencies attending the employment of the baking pan in common use."

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24. For a *Churn,* called a rocking churn; Nathaniel Tiffany,

and Ebenezer Robinson, Carolina, Tompkins county, New York, December 14.

A box is placed upon rockers, within this box slats are fixed, which serve as dashers, the cream passing between them as the churn is rocked. There is no claim.

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25. For an improvement in *Trusses for Hernia or Rupture;* James Knight, Baltimore, Maryland, December 14.

We shall merely give the claim of the patentee to what he deems his improvement upon Hull's truss.

"What I claim as my invention and improvement, is a truss which is made to press equally around the body, by means of an additional spring and fixed concave pad, the pressure being graduated by means of a strap and buckle, by which the truss is permanently sustained around the body, making it different in principle from all other trusses. My truss can be worn sitting, lying, or standing, with so little inconvenience as to be worn by the youngest infant."

The additional spring is a short elastic strip of metal, by which the pad is attached to the principal spring.

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26. For a *Compound Lever and Self-Weighing Scale;* Hosea H. Groover, Springwater, Livingston county, New York, December 17.

The specification of this patent describes seven different means of weighing by different apparatus, or by modifications of the same apparatus. The methods first described are on the principle of the steelyard, but are more complex, and we think less convenient than Dearborn's patent balance, an instrument which leaves but little to be desired in that way. The other means given are mere modifications of the bent lever, with an index to point out the weight.

The two kinds of apparatus, described and represented, appear to us to be so essentially different in their mode of action, as to require two separate patents. They are really different machines, although intended to attain the same end. The claim is to "the self weighing scale, and it compounded or blended with the steelyard or lever beam: and also the compounding the lever beam with the steelyard. The decimal graduations for weighing, and the appending cast iron notches and graduations to the wrought bar."

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27. For a *Machine for Shelling Corn;* William Hoyt, Vernon, Jennings county, Indiana, December 17.

This machine bears a strong resemblance to the first machine for shelling corn, which was patented some five and twenty years ago. A wooden cylinder has iron spikes driven into it, and between this and an elastic casing the corn is operated upon. The legs are framed together in the form of an X, and this appears to be one of the improvements claimed.

"The improvement which I claim is the particular construction or application of the frame to the machine.—Its simplicity.—The manner in which the machine is thrown in and out of gear by the moveable bridge trees. And the manner in which it discharges the cob, while the shelled corn passes through the machine.

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28. For an improvement in *Making Suspenders;* Allyn Baron, city of Philadelphia, December 17.

"The first improvement consists in substituting for brass or plated wire, which has been heretofore used for covering or wrapping the roller, pulley, or slide, spring, or cord, a substance commonly called sea grass."

"Second improvement consists in making use of a metallic ring, ferule, tube, plate, or piece; with holes to sew the same, and without holes, soldered and not soldered, to attach the said ring, ferule, tube, plate or piece, to the ends of roller, pulleys or slide, strings or cords for suspenders, whereby the said ends which have heretofore been knotted, burned, doubled, or whipped, are enlarged for the purpose of securing them to the loops, or button-hole pieces."

These may be great improvements, but the fraternity of suspender makers must judge of this. The law requires that there shall be "drawings, with written references, whenever the nature of the case admits of drawings." We are not aided by any thing of this kind, yet we think that a "metallic ferule, tube, plate or piece, with holes to sew the same," *admits of drawings.*

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29. For making and constructing *Steam Engine Boilers;* John C. Douglass, city of New York, December 17.

(See specification.)

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30. For a *Truss for the Cure of Reducible Inguinal Hernia;* Amos G. Hull, city of New York, December 20.

This is the fourth time a patent has been re-issued for this invention. It was first patented in July, 1817, surrendered and re-issued in February, 1823: again in August, 1824; again in October, 1829; and again as above.

These new patents all bear date with the first, and will expire on the 17th of July next. The object of surrendering and obtaining a new patent in the present instance is to use the amended specification in a litigated case. The lawyers certainly ought to know best, but we should be very apprehensive that a defective specification, which failed to explain clearly what was patented, would be likely to fail in sustaining what was intended, but omitted, to be described or claimed.

This truss is too well known to require description.

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31. For an improvement in the *Truss,* which the patentee

denominates the "Elastic Truss;" Gershom Twitchell, Leominster, Worcester county, Massachusetts, December 20.

The bow, or belt, or retractor, which surrounds the body, is to be made of Caoutchouc, (India rubber.) If pieces of sufficient length cannot be obtained, they are to be joined together by a cement made by dissolving the India rubber in about five times its own quantity of spirits of turpentine. This cement is to have the consistence of candied honey; the ends of the pieces to be joined are to be made perfectly clean, then thinly covered with the cement, and put for some hours under a press. The straps are at first cut of double their intended width, as they are to be folded over and their edges joined by the cement used for joining the ends. The caoutchouc strap is to be covered with soft leather; metallic clasps are to be attached to it, and metallic plates, with a cushion of caoutchouc; a covering of leather, hinges, and suitable springs, complete the truss. There is no claim made.

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32. For a *Washing Machine;* Ebenezer Lester, Killingworth, Middlesex county, Connecticut, December 20.

This washing machine differs in its structure and mode of operation from all those which we have hitherto described. It consists of a cylindrical vessel, the bottom of which is to be fluted on the inside, the flutes proceeding in radii from the centre; the sides are also to be fluted a few inches up. There is to be a dasher, consisting of a block of wood, with a shaft attached to it like that of a churn. The lower side of the dasher is to be fluted like the bottom of the vessel. The clothes are to be put into the vessel, with a sufficient quantity of water, and the dasher placed upon them; its shaft is to pass through a lid or cover. On the top of the dasher is a cross bar, or handle. "The machine may be operated by a person turning the dasher, horizontally, half, or quite, round and back. By this means a great saving of time and labour will be effected, without injury to the articles washed, as experiment has amply demonstrated."

"The inventor does not hereby claim as his invention, vessels, fluted work, or rollers, but merely the manner of improving them by uniting their operations in the mode above mentioned."

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33. For a *Washing Machine;* Samuel Bushnell, Sen. Saybrook, Middlesex county, Connecticut, December 20.

We may transcribe without any variation, what was said in our last number, p. 167, respecting a similar machine. "A swing frame with a roller at the bottom of it, is made to vibrate by hand. The clothes are placed in a trough, with bed pieces of suitable curvature."

There is no claim, and as similar machines have been long since patented, tried, and condemned, we apprehend that the want of a claim will not be a source of loss.

To this we may add, that the drawing is without written references.

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34. For a *Churn;* Samuel Bushnell, Sen. Saybrook, Middlesex county, Connecticut, December 20.

The shaft, or handle, of a common dasher churn is formed into a double rack, between the teeth of which a pinion is made to revolve by turning a crank. The teeth of the pinion are to take alternately into those of the racks, and the dasher is consequently to be made to rise and fall. A worse mode of accomplishing this purpose could not easily be devised.

There is no claim; no letters of reference to the drawing, and we may again add, but little likelihood of loss from these omissions.

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35. For a *Revolving Grate for Grating Apples,* and other vegetable substances; David Flagg, Jr., city of New York, December 20.

The grating is to be effected in a well known mode, that is, by a cylinder furnished with teeth. The improvement made consists in the vertical end of the hopper, just above the cylinder, being formed of slabs, or bars of wood, retained in their places by spiral springs, which will allow them to give way, when stones, or other hard substances, are encountered by the cylinder. To these the claim is confined.

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36. For an improvement in the *art of Boring Timber;* Frederick Beckwith, Saratoga, Saratoga county, New York, December 21.

A frame is made, having two uprights, or cheeks, like those of a standing press. Within this there is a sliding frame, passing freely up and down. A cylindrical vertical shaft fits and turns freely in holes at the top and bottom of the sliding frame; the augers, or bits, with which the boring is to be performed, are adapted to the lower end of the shaft. By means of a crank, or handle, motion is given to a vertical wheel, the cogs of which take into those of a horizontal wheel upon the shaft.

The machine is intended to be used in ship, bridge, and dock building, and for other purposes. We are not informed what part is claimed, and it resembles other machines for the same purpose so closely, that we should be at a loss in designating what is new in it.

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37. For an improvement in the *mode of Propelling Spindles,* or machines for spinning wool; Russel Phelps, Andover, Essex county, Massachusetts, December 21.

(See specification.)

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38. For a *Machine for Jointing and Gumming Old Saws;*

Henry Johnson Sidney, Delaware county, New York, December 23.

This is called an improvement on Newton's machine, for the same purpose. A lever, the fulcrum of which is near to one end, is used to force up a cutter with a triangular face, against a steel plate or bed. There is no difference in principle, but merely in arrangement, between this and the machine upon which it is called an improvement. The patentee, however, enumerates its good properties much at large. He tells us, for example, that "it need not be half the weight of Newton's." That "the principal plate need not exceed 13 inches in length," &c. The claims are to the particular manner in which this instrument is made. Among them is the "making the base, perpendicular, side guides to the driver, and supports to the fulcrum, all of one solid piece of iron," &c. &c.

In what the present patentee calls the original machine, we thought that there was but little originality, as may be seen by referring to our last volume, page 228. It must also be recollected that as this is confessedly an improvement upon Newton's machine, the consent of the original patentee is requisite to give a right to use the improvement.

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39. For an improvement in *Making Wheels for Carriages;* Joel Eastman, and Guy C. Rix, Bath, Grafton county, New Hampshire, December 23.

The spokes of the wheel are not to be driven into mortises, but are of such a size at their inner ends, that when laid together in their proper positions, they come in contact with each other to a distance of several inches, and sustain each other; an axle passes through the centre of the wheel, and is secured there by an iron plate on the outside, and another on the inside, which cover the joinings of the spokes, and are firmly pressed against them by screws, or otherwise.

The axle, which is to be of iron, is to be "laid into a wooden axle tree, and secured in such a way as to turn freely, and yet be perfectly secure against coming off."

"The invention here claimed, is the mode of making carriage wheels as before described."

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40. For a machine for *Cutting Screws, and Turning Iron and Steel;* Joel Eastman, and Charles Abbot, Bath, Grafton county, New Hampshire, December 23.

In this machine the cutting property of a disk of soft iron, or steel, when in rapid motion, is applied to the forming of threads upon screws of iron. The cutters are circular disks of from a foot to 4 or 5 feet in diameter, and of the thickness required. Their edges receive the form intended to be given to the thread of the screw, whether square, or angular. These wheels are fixed upon arbors, which are placed at such an angle with the piece to be cut, as the

intended thread may require. A sliding frame of iron, with the necessary slides, guide screws, and other adjustments, receives the piece upon which the screw is to be cut, and causes it to advance as the operation is performed. The claim "is the application of the iron or steel wheel in cutting screws, screw bolts, and taps, and turning iron, steel," &c.

This, we believe, is the first machine to which the remarkable property possessed by soft iron in rapid motion, has been applied; excepting the occasional use of it as a cutter in the lathe. The machine is in actual operation, and we are assured, upon good authority, that it not only acts perfectly well, but performs the labour of cutting screws with a degree of rapidity, which leaves at a great distance, every other known mode of effecting this object.

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41. For an improvement in *Percussion Gun Locks;* Michael Carleton, Haverhill, Grafton county, New Hampshire, December 23.

A straight bar of steel is contained within the stock, behind the breech pin. This, by sliding forward, is to operate as a hammer, to fire the powder. The guard operates as a spring to force this bar forward, the fore end of it passing through a small mortise, and entering a notch in the box, or hammer. When the hammer is drawn back, it is caught and held by the trigger. There is a very minute description of all the parts of the lock, but no claim made; we are not aware, therefore, of what is intended to be patented. Percussion guns have been made to resemble walking sticks, and a hammer used, the position of which was like that described: concealed locks of various kinds are also known to those conversant with this subject. We see nothing in the present plan which offers much either of novelty or utility.

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42. For an improvement in *Machines for Separating Gold from Sand, Earth, &c.;* Frederick D. Sanno, Philadelphia county, Pennsylvania, December 24.

This patent is taken for two machines, to be used either alone or in succession. The apparatus the patentee calls the *American Gold Finder;* without the drawings the particular arrangement of the parts cannot be explained. The first machine is called a preparer; in this the particles of gold are to be separated from the stones, and the lighter portions of earth. The washing is effected in a cylindrical vessel placed like a bolter, allowing the heavier particles to pass through into a box below. This portion is to be further washed in the second machine, which is called a cleansing machine. In this it is subjected to the action of sieves, vibrating troughs, and other appurtenances. The claim is as follows.

"What I claim as my invention is the construction and arrangement of the before described machines for separating gold from earth, stones," &c.

This general kind of claim, when a machine consists of many parts not new in their structure, does not appear to us to fulfil the requirement of the patent law, which makes it necessary that the applicant for a patent for any machine should distinguish the same "from all other things before known."

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43. For a method of *Manufacturing Spoons from Tin Plate*, Tin or Pewter in sheets, sheet Silver, or other metal; Robert Butcher, city of Philadelphia, December 27.

(See specification.)

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44. For an improvement in the machine for *Trashing Wheat*, and other grain; Rufus Humpreys Victor, Ontario county, New York, December 27.

This machine is so precisely like a great many other thrashing machines, that we should not, unaided, have discovered any point of difference; the patentee, however, informs us that "it differs from all machinery of this kind now in use, in the simplicity of its machinery, and the cheapness of its construction, it being designed to be propelled by one horse." This one horse is to apply his power in the usual manner. In this thrashing machine, "the rows of teeth on the cylinder play between similar teeth, fixed in the same manner on a bed piece. The cylinder and bed piece are both covered with sheet iron, and the teeth are drove through this. Between this bed piece and the cylinder the straw to be thrashed passes. The machine is fed by an apron leading to the cylinder, in the common way." Thus endeth the specification; there being nothing in the form of a claim, unless the *simplicity*, and *cheapness*, are intended as such; but to us these are not only intangible, but invisible.

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45. For an improvement in the mode of *Making Ivory, Bone, and Wood Combs;* Julius Pratt, Minden, New Haven county, Connecticut, December 28.

The back of the comb is to be made in a separate piece, and it is recommended to form it by turning. This piece is to be drilled to receive the teeth, which are also to be in separate pieces, and are to be formed by turning, or otherwise. Both the back and the teeth are to have the grain of the material running lengthwise.

"This improvement in the combs made in this manner, for which a patent is claimed, consists in having the back and teeth of the comb both running with the grain of the material of which they are made, whereby their strength and durability are greatly increased. This improvement is particularly useful in the making of ivory combs, as it greatly increases their strength and durability, and enables the operator to construct the teeth of the comb out of pieces, or chips of ivory, which are nearly useless for other purposes."

"I claim as my invention and improvement the comb of the above description, made of ivory, bone, or wood, with the grain running

lengthwise with the teeth and back. I also claim as my invention and improvement, the mode of forming the back and teeth by turning them, as above described."

The present patentee, if he is "the true and original inventor," has been rather tardy in asserting his claims. On the 14th of April 1829, Nathaniel Bricknell of Connecticut obtained a patent, in which it is stated that "this improvement consists in forming the back of a comb in a separate piece, or separate pieces of wood, so fastened to the back of the comb blade as that the grain will run at right angles with the grain of the wood forming the comb blade and comb teeth."

On the 11th of June in the same year, a patent issued to John Brown, of Providence, Rhode Island, for making small toothed combs out of small scraps, by connecting such pieces to pieces of hard wood, horn, or any other suitable substance.

The interference of these claims is perfectly manifest, and either one or the other of these patents must be untenable.

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46. For an improvement in the *Steam Engine*, and feeder of the boiler; Ogden Mallory, Oswego, Oswego county, New York, December 28.

The object in view will be seen by the following claim.

"What I claim as new, and as my own invention, or discovery, is the application or power of steam to a reciprocating, or semi-circular cylinder, or engine, or a semi-reciprocating rotary motion, or piston head, or wing, &c. And obtaining from such reciprocating or semi-rotary motion, or piston head, a full rotary motion; and thereby obtain the power of steam for propelling or driving machinery of all kinds," &c.

"And for feeding the boiler by a turning or revolving cock or cylinder, and keeping the water regular in the boiler, and at its proper point at all times," &c.

"And for regulating the force pump, or the supply of water for the boiler, by means of a valve or stop cock attached to the force pump, and adjusted by means of being connected to a weight in the boiler, which rises, or falls, with the water in the boiler."

Without possessing any of the advantages proposed by the rotary engine, the one here offered appears to us to unite all the objections to it; and we apprehend that it will be as difficult to obviate them as to make a "*semicircular cylinder.*"

A semi-cylinder is made, and closed at its ends, and across its diameter. Within this a wing is fitted, which is attached to a shaft, working on gudgeons in the centre of the circle, of which the semi-cylinder is a section. This wing must be packed so as to fit at its three edges, and the shaft to which it is attached, must also be packed to render it steam tight. The steam is to be admitted and discharged from each side of the wing alternately; and it is thus to be made to vibrate. A crank, or lever, firmly attached to one end of the shaft, gives motion to a fly wheel, by means of a shackle bar, or pitman. So much for this part of the invention.

The feeding is to be effected by means of a revolving, or vibrating cock or cylinder, which having cavities in it receives water from a supply vessel above, and carries it down, so as to deliver it within the boiler. This is one of the *Modern antiques*, which has been used both with, and without the sanction of a patent.

The third improvement is to be carried into effect by means of a float in the boiler, having a rod attached to it, which passes through a stuffing box. The upper end of this rod, is to be made to operate upon a cock, or valve, connected with the force pump, so as to regulate the quantity of water it shall supply. If floats, cocks, and force pumps, were not liable to get out of order, a contrivance of this sort might possibly be relied on; but as such is not the fact, this and the analogous appendages which have preceded it, are not likely to afford the desired security.

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47. For an improvement in the mode of *making Cotton Roving;* Samuel P. Mason, Leesville, Middlesex county, Connecticut. Patent first issued June 24th, 1830. Cancelled and reissued, December 29.

The specification commences by saying, "the essential principle which I claim in the speeder for making cotton roving, and which distinguishes it from all other speeders now in use, consists in the peculiar structure of the spindle, and the application of the flyer to that spindle."

The objection of a want of claim, which we originally made, is here removed; but the remark respecting the impracticability of making the nature of this machinery known without the drawing, still applies. We do not, therefore, attempt a description of it.

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48. For a *Machine for Tempering Clay and Moulding Bricks;* John C. Porter, Powhatan county, Virginia, December 29.

The clay is tempered by pairs of rollers running in troughs: there may be three, or more, such pairs placed below each other; the clay is placed above the upper rollers, and passes down through those below. A supply of water is admitted to the upper trough, in quantities sufficient for the intended purpose.

The moulding is effected in a circular trough. This trough is constructed much like those most commonly employed for tempering clay, and it has also a vertical shaft, and a roller running round in it, in a manner similar to those used for that purpose; but in the present instance the roller is employed to press the tempered clay into moulds. Single or double moulds are placed round in the trough, there being proper openings in the side of it to admit them. The tempered clay is placed within the trough, and the roller passing over it, presses it into the moulds. An iron scraper follows the roller, and removes the superfluous clay from the moulds. The bricks are then to be discharged, and the moulds replaced.

The claim is to "the machine, before described, for tempering clay, and moulding bricks; particularly the circular trough, the supports to the moulds, the cylindrical presser, and scraper."

If the claim to the whole machine is good, those to the particular parts are, at least, superfluous; if the claim is not good, it cannot be sustained by claiming the particular parts.

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49. For a mode of *Causing Cloth to pass, and be stretched while passing, over a Revolving Cylinder* prepared with points, or teazles, for teazing, or raising, the pile or nap upon cloth; John Jewell, Dudley, Worcester county, Massachusetts, December 30.

The specification of this patent is written with unusual precision and clearness, and the machinery described is well represented. All we can give is a general idea of the plan pursued, so far as it can be understood by a quotation from the beginning, and another from the end of the specification. The whole description would occupy several pages of the Journal.

"The cloth to be teazed, is to be wound upon a revolving cloth beam, and from that made to pass over and under rollers, and over the revolving cylinder prepared for teazing it; and over and under rollers on another revolving cloth beam, on which it is to be wound up as it comes from the first beam, after having passed over and under the rollers and cylinder aforesaid; and then, by a change of motion, after it has been unwound from the first beam, it may be made to pass back over and under the rollers and cylinder aforesaid, and be again wound upon the first beam, as it comes off from the beam upon which it was last wound up, the motion of the cloth beam and rollers being given, regulated, and changed, in the manner hereinafter described and explained, which description may be best understood by reference to the plan hereunto annexed."

Conclusion.—"It is to be understood that although I have in my plans, and the explanation thereof, mentioned a cylinder prepared with points or teazles, for teazing cloth, yet, I do not claim as a part of my invention, such a cylinder, either separately, or in combination, nor the raising of naps on cloth by means thereof; and although I have mentioned stretching rollers, which ought to be the stretching rollers now used for stretching the cloth widthwise, yet I do not claim the same, either separately or in combination, as a part of my invention, nor the stretching of cloth widthwise. And, as to the rest of the machinery described, none of it is claimed separately, and only so much of it in combination as is adapted to give motion to, and regulate and change the motion of, the feeding rollers, so as to regulate and change alternately the motion of the cloth, and draw it tight and smooth over the cylinder prepared for raising the nap upon it."

Specifications of American Patents.

Specification of a patent for an improvement in the art of heating or warming rooms, dwelling houses, offices, hot houses, churches, or any other public or private building, of any description or size, by means of a machine, apparatus, or implement, which he denominates a "Portable Steam and Hot Water Stove." Granted to Thomas Green Fessenden, *Attorney at Law, Charlestown, Middlesex county, Massachusetts, December* 14, 1830.

My improvement consists in a portable steam and hot water stove, which may be constructed as follows, viz. the case, or outside, may be made of cast iron, sheet iron, wrought iron, or any materials which will withstand fire; including all those which are or may be used for fabricating stoves or fire places. This case may be a hollow cylinder, or of an elliptical shape, a square, a parallelogram, or any other shape which taste, convenience, or fancy may dictate. Its dimensions should be of a size proportioned to the size of the room which it is wished to warm. A cylinder, 24 inches in length and 12 inches in diameter, fitted with boilers and tubes, as hereafter mentioned, has been found by experiment sufficient to heat about 3000 cubic feet of space in a room finished in the common style, and as well adapted as usual for the exclusion of external air. The case of the stove may be placed in a perpendicular position, elevated on legs or otherwise, so as to stand about two inches above the hearth or floor of the apartment. The lower end of the cylinder being closed with a plate of iron, or other suitable substance, serving for the bottom of the ash pit, which may occupy about 6 inches of the lower end of the cylinder. This plate may also extend several inches in front of the stove, and its exterior extremity being properly supported by legs or otherwise, answer the same purpose as a hearth for a fire place, and a footstool, or stand, on which the feet may be placed for warming. An aperture closed by a door near the bottom of the cylinder is used for taking away the ashes. This door may be fitted with a register to admit more or less air, as in common stoves.

Immediately above the ash pit, within the cylinder, is placed one or more boilers. The first, or lower boiler, is hollow sided, and consists of two concentric tubes of equal lengths, but of different diameters; the length about five inches, and the diameter of the outside tube just equal to the interior diameter of the case; so that the sides of the case and the boiler may sit close, and no air admitted between them can make its way over the fire place and carry off the heat. The tube which constitutes the inner part of the boiler, is about two inches less in diameter than the outside tube, which forms the exterior part of the boiler. Circular end pieces are soldered between the tubes at both ends; the upper end piece being perforat-

ed with several holes to admit two, or more tubes, leading to a second boiler; and, likewise, there is an advantage in having two, or more tubes, leading to the first steam receiver, as well as two, or more tubes, of about an inch in diameter, placed on the same level, and crossing the interior of the boiler, near its bottom.

Within the hollow sided boiler, is placed a grate, on which is a hollow, cylindrical vessel of cast iron, or other suitable metal, or substance, for a fire pot. These should be so shaped and placed, as not to touch any part of the boiler, or tubes, before mentioned, lest, when heated to a red heat, they should burn out, or unsolder the tin with which they come in contact. Within the cylinder, or case, and about six inches above the top of the first boiler, is placed a second boiler, set perpendicularly over the fire bed. The second boiler communicates with the first boiler by two, or more, tubes, placed at opposite sides, of about an inch diameter; and if there are enough of them to extend quite round the periphery of the boilers when placed an inch apart, except at the doorway, where the fuel is introduced, there will be an advantage arising from their exposing a large surface of metal and water to the action of the heat. The second boiler need only be about an inch think on the inside, and its circumference, or horizontal diameter, should be such as to leave a space of about an inch between the sides of the case of the stove, and the sides of the boiler. Between the hollow sided boiler and the boiler last described, an aperture is cut in the front part of the case, to which a door is adapted for introducing the fuel. This aperture may extend nearly half round the stove, its bottom being about on a level with the top of the lower boiler; and the top of the door way should be about two inches beneath the bottom of the second boiler. When the stove is in use, the door may be kept open, and thus give at once a sight of the fire and the advantage of its radient heat. Between the second boiler and the top of the cylinder, and as near the top as is practicable, the smoke is delivered by a pipe leading into a chimney, or other avenue for its escape, as in common stoves. The top of the case, or cylinder, may be closed by a lid of sheet iron, through which a tube, or several tubes, leading from the top of the second boiler, into the first steam receiver, ascend. Or the first steam receiver may rest upon and close the top of the cylinder. It will be well to have three, four, or more tubes, of about an inch in diameter, leading from the top of the second boiler into the lower steam receiver. These tubes may be placed at equal distances, near the periphery of the second boiler, and lead in a perpendicular direction into the first steam receiver. Or a single tube, of from two to four inches in diameter, may lead from the centre of the second boiler to the centre of the first steam receiver. A short tube, of about one inch in diameter, enters the lower boiler about an inch from the bottom; projects, horizontally, through the case about three inches, and is fitted with a cock for drawing off the water when it is wished to empty the boiler. A similar, but smaller tube, enters the steam receiver just above the fire line of the stove,

and near the bottom of said receiver, for the purpose of ascertaining when there is water in the stove in sufficient quantity for putting it in operation, without danger of unsoldering the tin, and for drawing off that water which is not necessary to prevent the tin work from being burned or unsoldered.

The steam receivers consist of several vessels of tin, or other suitable substance, (not copper, for the effluvia of that metal when heated is unwholesome,) placed perpendicularly over the boilers before described, with which, and also with each other, they communicate by steam tubes. The number and dimensions of the steam receivers should be proportioned to the size of the fire pot, boilers, and the cubic space which it is intended to warm. From actual experiment, I am induced to believe, that a cylinder, fire pot and boilers, fitted as above, would require about fifteen superficial feet of steam receivers to condense the steam generated in a cylinder, twelve inches in diameter and two feet in length, fitted with boilers and tubes as mentioned above; and this apparatus will be sufficient to warm about 3000 cubic feet of space, as stated above. The steam receivers may be of any shape which convenience, or fancy, may dictate, but it will be expedient to have them so placed and shaped that they may present a large surface in proportion to their capacity. The form which I have adopted, and which may perhaps be as eligible as any, is that of flat, circular vessels, each about $\frac{1}{2}$ inch thick, or perpendicular depth, and placed about three inches perpendicular height, one above the other, with a gradual decrease of horizontal diameter from the lowest upwards. For instance, suppose the lowest steam receiver to be about 15 inches horizontal diameter, and to rest on the top of the cylinder, or case, of the stove. The next steam receiver may be 14 inches horizontal diameter, placed three inches above the first, with which it communicates by three or more tubes, of about $1\frac{1}{2}$ inch diameter, placed about equi-distant, near the outside of the receivers. The next steam receiver may be placed 3 inches higher, and be 13 inches horizontal diameter, and so on until they are six in the whole, and the upper one is ten inches in horizontal diameter. These flat, circular vessels, are surmounted by a vessel resembling the frustrum of a hollow cone, placed three inches above the upper steam receiver, with which it communicates by a tube or tubes. This vessel may be large enough to hold about three quarts, and into this, water is poured to fill the boilers. It has a lid, or cover, similar to that of a common tea kettle, which is made to sit somewhat loosely in its place, so as to admit air by its sides, and thus prevent the steam receivers from collapsing by the pressure of the atmosphere when the steam condenses, and to admit a portion of the steam to escape when there is more generated than can be condensed by the steam receivers. A damper should be fitted to the smoke pipe, as in common stoves.

Although I have adopted the above mentioned form of construction in the steam stove, yet this may be varied indefinitely; and as the statute declares, that simply changing the form and proportions of

any machine shall not be deemed a discovery, I shall hold the unlicensed adoption of the principles of my stove, under any possible form or modification, to be a violation of my patent right.

The novelty of the invention consists in an easily portable apparatus, which presents a convenient mode of arresting the heat produced from combustion on its passage from the interior of the stove to the chimney, by exposing as large surfaces of water as is conveniently practicable to the action of the caloric, and distributing the latent heat of the steam thus created, where it is most wanted; and condensing and bringing it back to the boilers without the apparatus of valves, syphons, &c. heretofore thought necessary in heating apartments by steam.

Observations by the Patentee.

THE heat which is generated by the combustion of fuel, is either *combined* or *radiant*. Combined caloric is united with the smoke vapour and heated air which rise from the burning fuel; and in common stoves and fire places, nearly the whole of the combined caloric escapes by the smoke-pipe, or chimney, and is lost. Count Rumford asserted that the quantity of combined heat which thus escapes, is much more considerable, perhaps three times greater at least, than that which is sent off in rays. And yet, small as is the quantity of this radiant heat, it is the only part of the heat generated by the combustion of fuel burnt in an open fire place which is ever employed, or which can ever be employed, in heating a room. The metal and water contained in the apparatus above described, intercept and form reservoirs for this combined heat; a part of it is detained, and distributed from the lower part of the apparatus, and a part entering the steam receivers, presents extensive heated surfaces to the air of the room, by which it is speedily and effectually warmed. Water possesses the greatest capacity for heat of any known substance, whether it be compared with equal bulks, or weights. A gallon of water, heated to 212 degrees, contains at least 500 times as much heat as a gallon of air at the same temperature. Hence, a bottle of hot air for warming the feet, &c. would not be more than one five-hundredth part so efficacious as a bottle of hot water, of the same bulk and temperature. Besides, air, when heated, becomes specifically lighter than the air in its neighbourhood; of course has a tendency to ascend and carry its caloric with it to a higher position, where its heat is diffused without answering any good purpose in economy. And in common stoves, the air of the room which is warmed is vitiated by coming in contact with a surface of hot iron, often heated red hot, by which its mass is rendered less fit for respiration, and head ache and languor are induced. But in my steam and hot water stove no part of the apparatus is heated much, if any, above the temperature of boiling water, the small particles of dust which float in the air not being burnt, it remains fresh and uncontaminated.

That an apparatus for heating rooms by hot water and steam, which

is portable, and requires but little care or skill in its attendance, is *new*, as well as useful, may be made evident from the following passages quoted from the British writers who have published works on warming and ventilating rooms, &c.

In a work entitled "Practical and Descriptive Essays on the Economy of Fuel and the Management of Heat," by Robert Buchanan, p. 240, it is stated that "although in situations in which there is a steam-engine, or a regular supply of steam kept up for other purposes, it may be proper to use steam for warming buildings, yet, when that is not the case, unless a person can be appropriated to the sole purpose of attending on the boiler, I should hesitate to recommend it." It is likewise observed in Tredgold's "Treatise on Warming and Ventilating Rooms," &c. p. 19, "Wherever steam is employed, it should be under the direction of a person competent and willing to attend to it. For though, in such hands, it is perfectly safe and easily managed, it is by far too complicated to be trusted in the hands of careless and ignorant people." It is also observed in a treatise entitled "The Theory and Practice of Warming and Ventilating Public Buildings, Dwelling Houses, &c. by an Engineer," published in London, in 1825, that "it will seldom be found adviseable to use steam in warming dwelling houses, unless the establishment of servants is very numerous." My steam stove requires less attention than a common fire place. A small quantity of water (eight or ten quarts,) will answer for a whole winter, as the steam is condensed and brought back into the boiler. The apparatus is perfectly free from any danger of bursting or exploding, as the steam is not confined, nor its passage obstructed until it reaches the upper steam receiver, which is closed only by a lid, sitting as loosely as that of a common saucepan.

Among the advantages which a portable steam stove possesses over a common stove, may be numbered its security from communicating fire to the apartment in which it is placed, as the fire place is surrounded and surmounted by water. Moreover, the steam receivers furnish a series of shelves, standing one above another, on which plates, dishes of meat, &c. may be kept hot; or linen, vegetables, &c. &c. may be dried.

THOMAS G. FESSENDEN.

A, A, A, A, the cylinder enclosing the fire place. B, B, the first side boiler. C, fire pot. D, D, tubes leading from the side boiler to the steam receiver. E, second boiler. F, F, tubes leading from the second boiler to the first steam receiver. G, G, G, steam receivers. I, I, tubes leading from one receiver to another. K, K, cocks for drawing off the water. L, smoke pipe leading into a chimney.

Fig. 1. *Perspective view of the stove.*

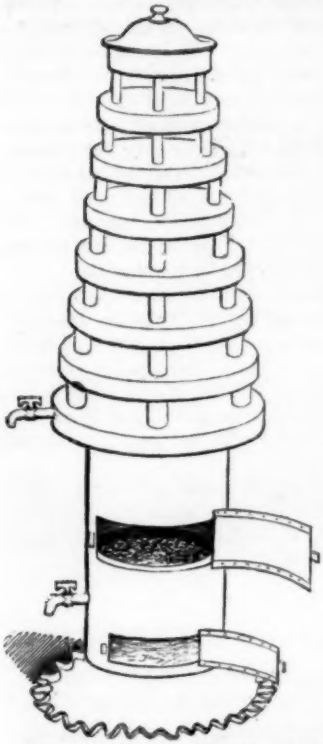
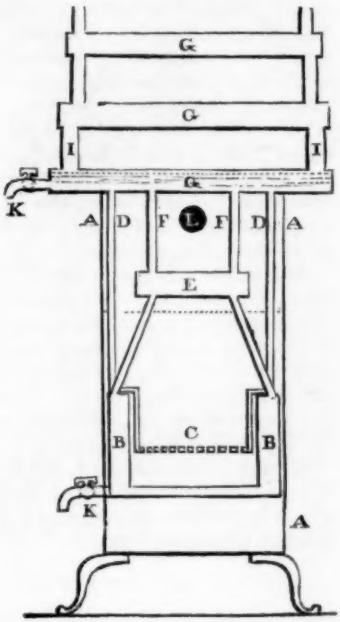


Fig. 2. *Section.*



Remarks by the Editor.—We have no doubt that the stove described in the foregoing specification, is a very good one, as regards the economy of heat, and the equable manner of its diffusion. Still a large portion of the heat extricated in the combustion of the fuel is liable to escape from this, as well as from most other stoves. The smoke pipe, L, leading into a chimney, must carry off both heated air and vapour, the *uncombined* heat of which must consequently be lost. If it is supposed that a stove of this description will absolutely give out more heat than one of the ordinary construction, this supposition is erroneous. The heat in a stove, or other fire place, is all extricated in the combustion of the fuel, and if, in a stove, the pipe is of sufficient length, and exposes a sufficient surface to the action of the atmosphere, to allow the heated air to become cooled nearly to the temperature of the room before it escapes into the chimney, all that the fire is capable of communicating is obtained. The use of steam in the way proposed, will not in the slightest degree increase this quantity, although it may diffuse it more equally than a stove ordinarily does.

We do not think that the "Observations by the Patentee," proceed, in the first instance, upon principles which are correct. "Combined caloric," he tells us, "is united with the smoke, vapour, and heated air, which rise from the burning fuel; and in common stoves nearly the whole of the combined caloric escapes by the smoke pipe, or chimney, and is lost," and we are left to infer that such is not the case with the stove in question. The watery vapour which arises from burning fuel may be condensed, and made to give out its combined caloric, and if the pipe be of sufficient length, as before remarked, the *uncombined* or free caloric of the *heated air*, may also be liberated; but such is not the case with its combined caloric. The combined caloric of smoke, spoken of by the patentee, is a species, or modification, of caloric, with which we are unacquainted.

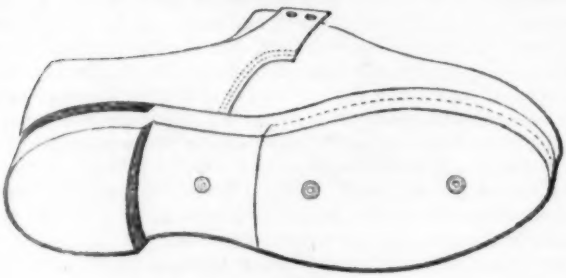
We think that the patentee has not chosen the proper place for his observations on the theoretical action, and the utility of his invention. These are matters which certainly do not belong to a specification. To us they appear as much out of place, as a disquisition upon the fertility of the soil, and the value of its products, would be in a deed of conveyance for a farm. In both cases, the metes and bounds are the proper subjects of description, in order that we may not lap over on our neighbour's property.

If such a disquisition is in place in a specification, there is nothing to prevent a patentee from writing a treatise upon the subject to which his patent relates, and sending it to the patent office to be engrossed upon parchment.

Specification of a Patent for an improvement in the mode of making or manufacturing Shoes and Boots, called the Farmer's double improved Boot and Shoe Sole. Granted to MOSES PENNOCK, *East Marlborough, Chester county, Pennsylvania, December* 14, 1830.

THE first lift of the heel of the boot or shoe, constructed at first in every other respect in the ordinary manner, is made to extend to that part of the shoe or boot which corresponds with the interior part of the hollow of the foot: that is to say, about two and a half inches beyond the heel forward towards the toe. To the top piece of the heel, as they are usually formed, an additional piece is then appended by as few nails or pegs as will serve to hold it firmly to its place. There is then fitted to the outer surface of that part of the sole which intervenes between the interior part of the extended lift of heel and the toe, a wearing sole, composed of a single thickness of sole leather, which is attached to the first mentioned sole by means of a sufficient number of nails, or pegs, driven at the distance of three-fourths of an inch, or an inch, apart, along its margin. Care should be taken in driving the pegs or nails, that they may escape the seams in the sole above.

Pennock's Farmer's Double Shoe.



Manner of Using.

When the outer sole and heel piece of a shoe or boot constructed in this manner are worn through, they may be replaced by others at a very small expense, and the superior heel piece and sole remain in as good wearing order as at first. The superior sole not being injured in its unexposed situation, may be used to great advantage as a wearing sole for new uppers after the first are worn out; and it is found by the experience of the inventor, to endure much longer than new and unseasoned leather. The outer sole and heel piece may be renewed at pleasure, as long as the uppers continue in good wearing condition.

MOSES PENNOCK.

Specification of a patent for an improvement in the art of Making and Curing Salted Beef, and particularly of the description called Jerked Beef. Granted to WILLIAM A. TOMLINSON, *city of New York, December 14th,* 1830.

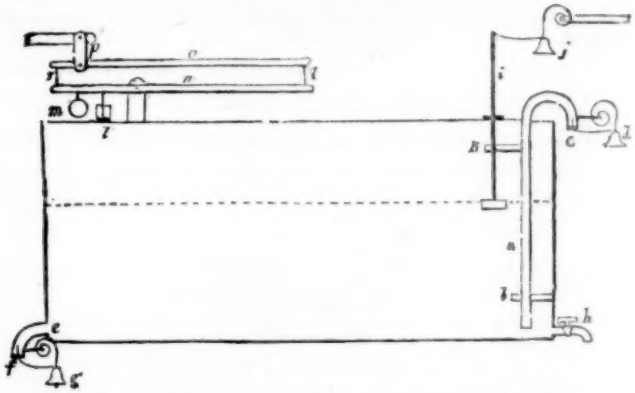
A ROOM, or building, of any description, intended to be used for the purpose, is to be warmed, or heated, by an open fire, or fires, or by a close stove, or stoves, or furnace, of any material or description, and the warm air allowed to circulate freely through it; and the beef being previously salted, or pickled, and cut in such form as best to receive benefit in drying, is to be placed in the room, or building, as above described, either by being suspended, or placed upon racks, or netting, or otherwise disposed, so as best to obtain benefit of the warm or heated air, and is thus to remain; its position to be changed if necessary, until it becomes sufficiently dried to keep; and may then be transported loose, or packed in boxes, or other packages, to any place for use: it is also a part of the process, when preferred, to furnish the room, or building, with windows, so as to admit the rays of the sun to aid the artificial heat or warmth in the drying process; or the beef may be alternately exposed to the artificial heat and the rays of the

sun, by removal from the room, or building, to the external, or open air, and returned again; and also *vice versa.*

The benefit to be obtained by the above process and its parts, in the making and curing salted beef, and particularly the advantage in the making and curing of jerked beef, over the mode hitherto practised for that article, (that mode consisting in drying the beef by exposure in the open air to the sun alone,) consist in drying the beef more uniformly and equally, gving it a better and sweeter flavour, and enabling it to be kept longer in any climate without spoiling; and is also a great saving in the expense and time of curing, as the drying goes on during any weather. The application of artificial heat, without the aid of smoke to the curing and preserving of salted beef, and particularly that description of salted beef usually called jerked beef, is a new invention and discovery, and is deemed an application of an *old* principle to a *new* purpose, of such importance as to be entitled to a patent. WM. A. TOMLINSON.

Specification of a patent for improvements in the making and constructing of Steam Engine Boilers. Granted to JOHN C. DOUGLAS, *city of New York, December 17th,* 1830.

J. C. Douglas' Steam Engine Boiler.



WHAT I claim as my specific improvements, consist, first, in having a pipe (*a*) of five inches diameter, near the furthermost end of the boilers, to go from the top to within two inches of the bottom, near which it is fastened by an iron stay (*b.*) The top of the pipe terminates with a vacuum valve, (*c*) having a bell (*d*) connected to it by a wire, for the purpose of notifying the Captain, or Pilot, of its motion.

Secondly. To insert in the front end of the boiler, at the height of two inches from the bottom thereof, another pipe of five inches diameter, (*e*) terminating with a vacuum valve, (*f*) having a bell (*g*)

annexed, (as with the first mentioned pipe,) to notify the engineer of its movement.

Thirdly. To have a water cock (*h*) in the front end of the boiler, at the height of two inches from the bottom thereof.

Should the engineer, on being notified by the ringing of the bell, (*g*) turn the cock, (*h*) he will find no water at the bottom of the boiler.

He must then damp the fire, open the safety valve, and, as soon as he finds water runs from the cock, (*h*) he may commence pumping into the boiler. (But if the cold water had been pumped into the boiler before the above preliminary steps were taken, it would cause the metal to have shrunk, and a rupture must have been the consequence.)

Fourthly. A floating water gauge, perforating the top of the boiler and indicating the number of inches of water therein, is formed of a hollow ball, with sufficient weight, just barely to immerse the ball in the water; attached to it is a polished piston rod, (*i*) which works through the stay, (*k*) and the *stuffed* box on the top of the boiler. A bell (*j*) connected with the piston rod by a chain, will give notice when the water has fallen to the level of the lowest water gauge.

In many instances the water-gauge-cocks, as they are now used, serve only to deceive the engineer; who, finding water to issue upon turning one of these cocks, naturally concludes that the water in the boiler is up to the height of that cock, while, in reality, it is several inches below it, (the water which issued from the cock being only the steam which had condensed in the tube.) The great pressure of the steam prevents the admission of the requisite supply of water, although the forcing pumps have put it in motion, and hence another cause of error.

Fifthly. A safety valve (*l*) having the weight (*m*) which the boiler is calculated to bear, suspended on its beam as usual, but the latter is extended beyond its fulcrum, (so as to form a lever of the first order,) and at the extremity of the longer arm (*n*) a chain (*g*) connects it with the end of the steelyard, (*o*) whose fulcrum (*p*) is raised a convenient distance above that of the safety valve beam. The shorter arm of the steelyard is then connected with the end of the beam on which the weight hangs, by means of the chain (*r.*) Now, whenever the steam begins to move the safety valve, it moves the other end of the beam down, which brings down also the corresponding end of the steelyard, and consequently, raises the other end with the safety valve beam on which the weight is hung, and the valve, being thus freed from the pressure of the weight, easily yields to the steam and lets it escape.

The steelyard can be so made that one pound of the pressure of steam can raise any weight necessary for the relief of the boiler.

In this last item, it is not the valve, but the appendages annexed thereto, as above set forth, that are claimed as the improvement; and which will render any boiler completely proof against any explosion, unless a greater weight on the safety valve beam is placed in the first instance, than the boiler is meant to bear. JOHN C. DOUGLAS.

Remarks by the patentee; prefixed to his specification.

I have observed through the medium of the public prints, that the greatest number of the disasters which have happened to the boilers of our steam boats, have occurred after the water has been heated to that degree which has turned it into expansive steam.

If the valve is now open to allow the steam to escape, because the boat is not quite ready to go, or if the boat is stopped for any other purpose, the steam is generally let off when there is a pressure of twelve pounds, or upwards, on the beam of the safety valve; throwing open the valve thus suddenly gives the whole contents of the boiler a volatility somewhat resembling that of a well corked bottle of soda water when the cork is withdrawn, and the whole would be discharged in a second or two, were the aperture sufficiently large.

The moment the valve is opened, the whole fluid flies from the bottom of the boiler, and the great heat which is under the bottom makes it red hot in a few seconds, and generates a highly rarified air, which forms a vacuum under the steam.

Again, the valve is shut to give the steam power to operate on the engine, and the steam being now confined with the rarified air, a contest now takes place between them for the sole possession of the boiler; in a few minutes an awful explosion must take place, too often attended with death as well as destruction.

The engineer, just before the disaster took place, may have tried his gauge cocks and have found them all full of water, which must have been the case; for the rarified air had driven the whole contents to the surface of the boiler, but not one single drop remained at the bottom; the vacuum valve on the top of the boiler is of no manner of use when the above described disaster takes place, for the whole surface is occupied by the pressure of the steam which keeps the valve shut.

The only time this valve is of service, is, when the boiler is receiving a supply of water, which, by condensing the steam, forms a vacuum, which is filled through this means by the exterior atmosphere.

John C. Douglas.

Remarks by the Editor.—We are unable to follow the patentee of the above described boiler, either in his theory or practice. We certainly accord with him in the first of his remarks, that an explosion rarely takes place in a boiler until "after the water has been heated to that degree which has turned into expansive steam." And if he is equally correct in all his assumptions, he is certainly the author of some notable discoveries; some in fact which must go far to revolutionize all the long cherished notions of philosophers on the subject of heat, air, and steam. It is a new discovery, that the rarified air at the bottom of a boiler will drive every drop of water to the upper part of it, and allow the bottom to become red hot. And unfortunately, the vacuum valve at the top, with its bell, will, in this case, be of no manner of use. It is a new discovery that the whole con-

tents of a boiler would fly off in a second or two, on opening the safety valve, were the opening sufficiently large. The terrible contest between steam and rarified air, to determine the question which shall have the sole possession of the apartment, is an event of which we had never before been informed. But we cannot pretend to notice all these important novelties, and the consequences to which they inevitably lead, as we have neither time nor space for the investigation.

Specification of a patent for an improvement in the mode of propelling spindles or machines for spinning wool. Granted to RUSSEL PHELPS, *Andover, Essex county, Massachusetts, December* 21, 1830.

IN all the machines now used for spinning wool, which are called jacks, or billies, or jennies, the mode of propelling the spindles is by applying the power to one end, or the middle, of a cylinder, from which the spindles are successively banded.

My improvement consists in applying the power to both ends of the cylinder at once; and in order to produce this effect, I make a shaft of sufficient strength and length, to extend the whole length of the spinning frame, and attached thereto, on the back part of the frame; on each end of which shaft I secure a pulley, or wheel; to this wheel or pulley, I attach a band or belt, which, after passing over fixed pullies, in front of the machine, is strained over corresponding pullies, on each end of the cylinder which drives the spindles. This principal shaft is driven from the centre, or from any other point in its extension; and the effect of communicating motion from both ends of the shaft, to both ends of the cylinder, is to give a perfectly steady motion to the carriage, to which the cylinder is attached, and of necessity to the spindles connected therewith, and thus to produce better work; it also comes in aid of the squaring bands, in maintaining uniform motion. The great advantage derived from applying the moving power to both ends of the spinning frame, is, that by rendering the operation of the machine more easy and uniform, the number of the spindles may be multiplied to suit the convenience of the opeartor. In the jacks and billies commonly used in this country, one hundred and twenty spindles are the usual number attached to each frame; by the introduction of my improvement, double the number can be driven with equal ease, and without any additional skill on the part of the operator. RUSSEL PHELPS.

Specification of a patent for a new mode of manufacturing Spoons from tin plates, tin or pewter in sheets, sheet silver, or other metal. Granted to ROBERT BUTCHER, *of the city of Philadelphia, December* 27, 1830.

To all whom it may concern, be it known, that I, Robert Butcher, have invented a new mode of manufacturing spoons from tin

plates, tin or pewter in sheets, sheet silver, or other metal, by means of cutting and stamping presses, and that the following is a full and exact description of my said invention.

When I manufacture spoons of sheet tin, I usually employ that which is known as three or four cross. This I planish, or hammer, with a polished steel hammer, upon a polished steel anvil. This not only polishes the surface, but condenses the metal, and thereby renders it the more durable.

When I use rolled sheets of block tin, pewter, silver, or other metal, or mixture of metals, I generally polish such sheets on both sides before proceeding to make the same into spoons; this, however, is not essential to the process.

In order to make the above named, or other metallic plates into spoons, I first cut the metal into the exact form required, by means of a steel bed, and cutter, in the way well known to the workers in metal. Any of the screw, lever, or drop presses usually applied to such purposes may be employed.

The blank or flat pieces for spoons being thus prepared, they are raised by means of a drop, or fly press, or by any other adequate application of power. A die, with a metal forcer, being employed for this purpose.

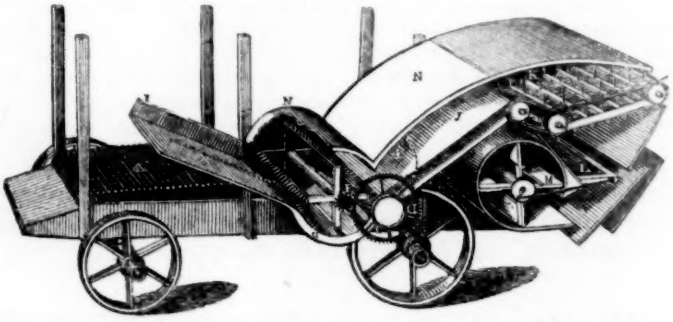
I do not claim to have invented any part of the machinery applied to this manufacture; but what I claim as new, is the manufacturing of spoons, without either casting or forging, by cutting and raising them out of sheet metal, in the way herein described; the same being a new manufacture.

ROBERT BUTCHER.

Specification of a patent for a machine for Thrashing and Cleaning Wheat and other grain. Granted to SAMUEL LANE, *Hallowell, Kennebeck county, Maine, April* 6, 1831.

Lane's Thrashing and Winnowing Machine.

Fig. 1.



To all whom it may concern, be it known, that I, Samuel Lane, have invented certain improvements on the machine for thrashing

Fig. 2.

and cleaning wheat and other grain, which I denominate the portable horse power thrashing and cleaning machine, and that the following is a full and exact description of the said machine with my improvements thereon.

The power which I employ to drive my thrashing machine is the endless chain, and railway horse power, patented by me on the 17th of May, 1830. The mode of doing this, and likewise the general structure of the machine, is represented in the accompanying drawings.

A, Fig. 1, represents the inclined plane upon which the horse walks. B, a cog wheel on the end of the larger drum, over which the endless chain passes. This wheel may be 21 inches in diameter, and the pinion, C,* which it drives, 6 inches in diameter. The wheel, D, may also be 21 inches, and the pinion, E, on the shaft of the beaters, 6 inches; these relative proportions affording a sufficient velocity to the beaters.

The beaters have teeth, which may be made either of wrought or cast iron; they are to have, on their faces, the wedge-like, pointed, form seen at F, Fig. 2.

The hollow segment, G, is best made of cast iron. It is furnished with teeth of the same form and length with those on the beaters. The manner in which the teeth on the beaters pass those on the segment is shown at H, F, Fig. 2, where they are drawn of one-fourth of their usual size, and of the requisite space between them to allow the straw and grain to pass. The teeth I usually make upwards of two inches in length, as when shorter than this, the same quantity cannot be thrashed, there not being sufficient space. The pointed, or wedge-like, form of the teeth, their greater length than in other thrashing machines, and the space allowed between them for the straw, are essential features of my machine, and distinguish it from others which have been made to thrash by means of teeth.

The inclined board, I, is for the purpose of feeding. The straw and grain, after the thrashing is completed, are received upon an endless apron, J, passing over rollers. On this they are carried up to the endless sieve and rake, K. This sieve and rake are thus made—slats of wood, the length of the rollers, are attached to leathern straps, or bands, passing round the end of the rollers. These slats may be two or three inches apart, and they have wires projecting from their edges, forming a sieve. From the faces of the slats spikes project which form the rake to lay hold of the straw. The grain and chaff falls through upon a screen, L. To this screen a vibratory motion is given, from a crank on the shaft of the fan wheel, M, or in any other convenient way. The endless sieve, and the fan wheel, are driven by bands and whirls from the main machine. N, N, is a covering extending over the whole machinery.

It is manifest that this thrashing machine may be driven by other means than my patented horse power; I, however, deem this the most convenient.

* B and C are a wheel and pinion on the opposite end of the machine.

What I claim as my improvements are the particular form and arrangement of the teeth as described and represented; the receiving the grain and straw upon an endless apron, and thus carrying it up on the endless sieve and rake; the particular construction of the sieve and rake, and the general arrangement of the machinery by which these objects are effected.

SAMUEL LANE.

We have caused to be translated for the Journal the various ordinances, issued since 1823, of the French government in relation to high pressure steam engines. The ordinances are accompanied by circulars, explanatory of their details, and which emanate from different boards composed of officers of the corps of mines, and of government civil engineers, selected with reference to their peculiar qualifications for the task imposed. [COM. PUB.

Royal Ordinance of France, in relation to High Pressure Steam Engines, followed by instructions, and a Circular, on the same subject. 1823.

[TRANSLATED FOR THIS JOURNAL.]

Ordinance relating to High Pressure Steam Engines.

ART. 1. High pressure steam engines, those in which the elastic force of the steam exceeds two atmospheres, whether they consume their own smoke or not, cannot be set up except by virtue of authority obtained in conformity with the decree of 15th October, 1810, for establishments of the second class.

They will, besides, be subject to the following conditions, imposed in order to insure safety.

Art. 2. When authority for setting up such an engine is requested, the individual requesting authority must state at what degree of pressure the engine is to be worked.

Such pressure must not be exceeded.

The pressure must be stated in atmospheres, or in the number of pounds to each square inch of surface exposed to the pressure of the steam.

Art. 3. No high pressure boiler can be used unless it has been previously subjected to trial by the hydraulic press.

Every boiler must be proved at five times the pressure under which the engine supplied by it is to work.

Every boiler shall be marked after being proved, with a number, expressing the pressure under which it may be used, corresponding to the proof.

No individual shall use a boiler which is not marked with a number at least equal to that representing the pressure under which he has stated, in his declaration, that the boiler is to be used.

Art. 4. There shall be two safety-valves placed upon the top of every boiler, one at each end. The size and load of each shall be

the same, and must be regulated, the former by the size of the boiler, the latter by the degree of pressure indicated by the proof-mark: the size of either valve will be so regulated that if raised alone, it may be sufficient to discharge the steam accumulated within the boiler.

The first valve shall be under the control of the engineer or fireman.

The second must be preserved from such control by being inclosed in a grating, of which the proprietor of the works, where the engine is used, shall have the key.

Art. 5. There shall in addition to these valves, be adapted to the top of each boiler two metallic plates, fusible at temperatures hereinafter to be stated.

The first of an area at least equal to that of one of the safety valves, shall be made of an alloy which shall melt, or soften so much as to yield to pressure, at 10 degrees of the Centigade thermometer, (18°F.) above the temperature corresponding to the proof-mark upon the boiler.

The second of twice the area of the first, shall be placed near and inclosed by the same grating, with the first safety valve: it shall be made of an alloy which shall fuse, or soften, at 20° C. (36 F.) above the proof-mark.

These plates shall be stamped with a number showing the degree of the thermometer at which they fuse.

Art. 6. No boiler shall be placed in an inclosure of less than twenty-seven times the capacity of the boiler.

The inclosure must be lighted, on two sides at least, by windows, closed by light shutters, opening outwards. It must not be contiguous to the walls of adjacent buildings, from which it must be separated by a wall of at least three feet thick, distant not less than two yards from the building. It must be separated by a wall of the same thickness from any interior workshop. There must be neither dwelling nor workshop above the boiler house.

Art. 7. The engineers of mines resident in the several departments, or in their default the government civil engineers, are charged with superintending the proving of the boilers, and fusible plates. They will stamp the proof numbers upon them with dies, which are to be furnished them for that purpose.

These engineers shall satisfy themselves, by inspection, at least once every year, that all the conditions prescribed are rigorously observed. They must examine the boilers, ascertain their condition, and cause to be thrown out of use, those which long continued wear, or accidental deterioration, may have rendered dangerous.

The local police authorities will keep a constant watch over the works using high pressure engines.

In case of non-compliance with the present ordinance, the proprietors of the works will be subject to a stoppage of the works, without regard to the penalties, damages, &c. which may be awarded by the courts of justice.

Art. 8. Our minister of the interior will cause instructions to be

published, stating the precautions to be habitually observed in relation to high pressure engines.

These instructions must be posted up in the works.

Art. 9. Our minister of the interior is charged with the execution of this ordinance, which will be inserted in the Bulletin of Laws.

Given, &c. Oct. 29th, 1823.

[Signed,] LOUIS.

CORBIERE, *Minister of the Interior.*

Instructions relating to the precautions to be observed in the use of High Pressure Steam Engines.

THE use of high pressure engines requires constant care on the part of the engineers and firemen, and constant watchfulness on that of the proprietors. By neglecting the necessary precautions, the workmen may give rise to serious accidents, of which they themselves will be the first victims. By relaxing in vigilance the proprietors of the works may be the indirect cause of such accidents, besides exposing themselves to the losses which must result from the destruction of the engine, and to the injury which their business must suffer from the stoppage of work.

It is the duty of the proprietor to trust the direction of the engine to none but a man of tried intelligence and capacity, who is not only sober, and active, but who is also without any impediment to the regular discharge of his duty. Nothing should interfere with this regularity, nothing disturb or distract the attention of the engineer, otherwise there can be no security in the works.

The attention of the engineer and proprietor should be directed particularly to the following parts of the engine, viz: the furnace, the boiler, and boiler-tubes, the supply pipe, the level of the water within the boiler, the safety valves, the gauge. There are precautions to be taken also in relation to the inclosure containing the boiler.

The Furnace.

The principle according to which the heating should be regulated, is to avoid sudden changes of temperature, from cold to heat, or the reverse; in either case, the boiler is exposed to more or less considerable inequalities of temperature, which, on account of the variable expansions caused, may occasion cracks and leaks. Thus, on first getting up the steam, the fire should not be urged too much, particularly if the furnace has been entirely cold. Time would be gained only at the expense of the safety of the boiler. When the fire has been raised to a height adequate to supply steam for the working of the engine, it ought to be kept up uniformly; it should, therefore, be stirred at proper times, and supplied with just the requisite quantity of fuel, and no more. The fire must not be suffered to go down during the continuance of the work; and if this should happen, fuel must not be supplied hastily, and in great quantities; such a supply would at first produce a chilling effect, and afterwards give out an excessive and dangerous quantity of heat.

The stirring and replenishing should be performed quickly, so as

to abridge the destructive action, which the cold air, introduced through the furnace door, would otherwise have, upon the boiler.

These precautions are not required when the self-regulating apparatus for feeding the furnace with coal, is used; in such a case the fireman must see that the hopper is supplied with coal, and that the supply from it is uniform and continuous.

Putting out the fire, when not carefully performed, is one great cause of the accidents which happen to boilers. The best method is to leave the unburned part of the fuel in the furnace, to close the register in the chimney, as well as the door of the ash-pit, and to stop up the crevices of this door, as well as of the furnace door, with clay. By proceeding thus, the sudden cooling of the boiler, and the rapid oxidation of its exterior surface, are avoided. Besides, the unburned fuel is turned to account; for, not having a supply of air, it goes out, and may be readily withdrawn from the furnace when it has cooled.

Of the Boiler.

However pure, water may seem to be, it deposits an earthy sediment which should not be allowed to accumulate. This deposit rapidly hardens, and increasing in thickness, it prevents the ready access of heat to the water within the boiler: thus, to supply the engine with steam, the fire must be raised, fuel is wasted, and the danger of decay and of bursting is increased.

Experiment has shown, that if potatoes in proper quantities be introduced within the boiler, the deposit is for a time prevented, the fecula of the potatoes keeping in suspension, the earthy sediment; but the viscous matter thus formed, as it increases in thickness, hinders the evolution of steam, and a period arrives, when its removal is indispensable; this period depends upon the nature of the water used. The proprietors of the engine should determine, by experiment, the proper period for cleansing the boiler, and also the least possible quantity of potatoes, if used, which will produce the desired effect. These investigations are required, not only by a regard to safety, but to economy; since the action of the fecula will retard the production of steam.

If, notwithstanding every precaution, a boiler-tube* should crack, the engineer ought, at once, to inform the proprietor of the fact, and the latter should instantly replace the cracked tube by a new one. Patching the tube would only conceal the mischief, and the danger of explosion would be incurred.

The proprietor and engineer should observe, attentively, the oxidation of the surfaces of the generating tubes, particularly if they be of cast iron. If they find reason to suspect that any of their boiler tubes are defective, they should prove them anew without waiting for the visit of the inspecting engineer. The same remarks apply to boilers; but as the means of observation are not so frequent, the engineer and proprietor should seize every occasion to ascertain the condition of the boiler; when, for example, one or more of the

* The tubes here referred to, are those below the boiler in Woolf's engine.

generating tubes are to be replaced—when repairs are to be made to the covering of the boiler, or when it is emptied to be cleaned, the indications afforded by leaks, should be carefully attended to.

When a leak is found at the juncture of the boiler head with the boiler, or at the head of one of the generating tubes, no attempt should be made, while the engine is in action, to close the joint by tightening the screws; by so doing, a risk would be run of cracking the head; in the event of its giving way, the workman would be killed by the splinters, or scalded by the steam and hot water.

When the generating tubes, or boilers, are to be cleaned, the proprietors should not require their workmen to let off the water while yet hot, particularly when the boiler tubes have not stop-cocks attached to them.

Of the Supply Pump, and the level of the water within the Boiler.

When a float is used to show the level of the water within a boiler, it is of the greatest importance that the level should be kept at that indicated by the horizontal position of the lever, attached to the float. The engineer must not, however, trust entirely to the horizontal position of this lever, for information; he must satisfy himself that the motion of the float is perfectly free. He must especially be certain that the stuffing, through which the stem of the float passes steam-tight, does not press too closely upon the stem, preventing its free motion, and rendering inaccurate the indication afforded by the float.

The same precautions are necessary, when the float, by its depression, opens a valve through which water is supplied to the boiler as it is wanted.

The supply pump should be carefully attended to. If, from negligence, the level of the water within the boiler should become too low, as soon as it is ascertained, the supply should be gradually increased, otherwise accident may result. The water rising rapidly in contact with the sides of the boiler, which the fire may have heated, might produce so great a supply of steam, that the pressure would be too powerful for the boiler to withstand. The danger would be imminent if, in such a case, the safety valves were out of order, or overloaded.

If an explosion should not be produced by a defective supply of water, the least evil which could occur would be the fracture of the boiler.

Safety Valves.

In the engines where these valves are under the control of the fireman, he should study their play, and ascertain exactly what degree of adhesion they have to the valve seats. This adhesion must be attended to, even when the surface of contact is very small. The fireman should satisfy himself, by frequent trials, that these valves have the freedom of motion necessary to their perfect working. In order to this, he should raise, from time to time, the arm of the lever, to which is attached the constant weight with which the

valve is loaded, to ascertain that the valve has not acquired an adhesion to its seat.

When the valves do not move freely, and when the maximum load which they are to bear, is placed upon them, they can fulfil their object but imperfectly; they confine the steam which should be suffered to escape; it accumulates, and may perhaps acquire an elasticity greater than that which the boiler can resist. This fatal effect might also be produced, if, in order to work the engine more rapidly, a weight has been added to that which constitutes the proper load of the safety valve. To overload the safety valve is exceedingly dangerous; ignorance of the danger incurred would constitute the only excuse for a proprietor who should order such a thing to be done, or for the engineer who should execute such an order. The firemen ought to be well aware, that one of the chief effects of an explosion would be to allow the escape of an immense quantity of hot water and steam, which would cause their death, or inflict extreme suffering.

Such accidents are much less to be feared in engines established in conformity with the royal ordinance of October 29, 1823, but the safety valves should not the less be watched, and kept perfectly free. In fact, if their play were stopped, ever so little, it would happen, upon the least increase of the fire, that the steam, instead of escaping, would accumulate, increasing in both temperature and elasticity; it would, after a time, melt the fusible plates applied to the boiler, the working of the engine would be thus stopped, and the proprietor must incur the inconvenience of the delay incident to the replacing of this plate. The proprietor should specially visit every day the valve under the grating of which he has the key. The valves should be ground very frequently, otherwise they will suffer the steam to escape. The necessity of keeping them in order is imperative, for the workmen can only render them tight by increasing the load upon them, and the proprietor cannot too strictly prohibit their being overloaded.

When the fire is left to burn out, or when it is covered up, in order to be relighted the next day, the workshop should not be left, before it is ascertained that the safety valves are unloaded, so as to permit the steam, which is still produced to escape freely.

Of the Steam Gauge.

The gauge, being connected with the interior of the boiler, shows always the rate at which steam is generated, and the degree of pressure produced by it. The variation of pressure is shown by the motion of the mercurial column in the glass tube, and the amount is measured by the scale attached to this tube.

This instrument, when properly constructed, is of the greatest utility: to preserve it from accident, it should be enclosed in an iron, or brass, wire grating.

The proprietor should ascertain that his engine-men are duly sensible of the advantages of this instrument, and understand the manner of using it.

It is the duty of the fireman to consult the gauge very frequently, and to be guided by its indications in regulating the fire, whatever may be the resistance, arising from the work to be done, against which the machine is acting.

Of the Inclosure containing the Engine.

In order to render the effects of explosion, should such accidentally occur, less dangerous, the boiler-house must be completely insulated. The materials stored in the works should not be deposited within several yards of it. The proprietor would violate the 6th art. of the royal ordinance of Oct. 29, 1823, if he should fill the space between the neighbouring buildings and the wall about the boiler-house, with resisting materials. This wall cannot answer the purpose of that ordinance unless it has an open space around it.

Finally, it is indispensably necessary that the boiler-house should be kept under lock, so that, in the absence of the fireman, no one can have access to it. We may imagine that if the safety valves should be overloaded, or kept down by wedging, after the fire has been covered up, the accumulation of steam might occasion an accident; precaution is as necessary in this case as in those dwelt upon above. The superintending care of the proprietor, and the vigilance of the engineer, should never be wanting at any time or under any circumstances.

(Signed,) Becquey,

Counsellor of State, and Director General of Civil Works and Mines.

Paris, 9th March, 1824.

Circular of April 1st, 1824, to the Prefects of Departments.

Sir,—You have been made acquainted with the royal ordinance of October 29th, 1823, relating to high pressure engines. According to the 8th art. of that ordinance, the instructions in reference to the precautions to be observed in the use of these engines, must be printed and posted up in the workshops.

The engineers of mines of the department, or, in their default, the government civil engineers, having been charged, by art. 7, with executing the principal parts of that ordinance, I assembled a board, composed of those members of both corps best acquainted with the subjects committed to them, and requested them to prepare a set of instructions in relation to the measures of precaution to be habitually observed, in the use of the high pressure engine. These instructions were approved on the 19th of last March, by his excellency, the minister of the interior.

I have the honour to transmit — copies. You will please to have the instructions printed, and posted up in workshops where there are engines, which come under the terms of the first art. of the ordinance of October 29th.

You will also transmit copies to the proprietors of engines, re-

questing them to make abridged extracts from them, applicable to the kind of engine which they use.

I am now preparing materials for a second set of instructions, in relation to the execution of the 3d, 4th, and 5th articles of the ordinance; these articles refer to the proof to which the boilers must be subjected, to the valves to be applied to each end of the top of the boiler, and to the two fusible plates intended to prevent explosions.

I shall have dies made, to be sent to the engineers whose duty it is to have marked upon every boiler, the degree of pressure with which it has been calculated to work, and according to which the proof has been made, as also, the temperature at which the metal plates attached to the boiler are fusible.

Under existing circumstances, to secure manufacturers as much as possible from accident, I beg you to attend at once to the execution of art. 6th of the ordinance, according to which a boiler must not be placed in an enclosure of less than twenty-seven times the capacity of the boiler.

The enclosure must be lighted on two sides at least, by windows closed by light shutters opening outward. It must not be contiguous to the walls of adjacent buildings, from which it must be separated by a wall of at least three feet thick, distant two yards from the building. It must be separated by a wall of the same thickness from any interior workshop. There must be neither dwelling nor workshop above the boiler-house.

I shall have the honour to transmit hereafter to you, and to the engineers of mines, and civil engineers, new instructions in relation to the valves, the fusible plates, and the application of the dies, &c.

(Signed,) Becquey,

Counsellor of State, and Director General of Civil Works and Mines.

On the Disease, called Painter's Colic, to which certain Trades are liable.

We have extracted from the valuable work on Poisons, by Dr. Christison, of Edinburgh, an account of the disease, known as the painter's colic, to which certain trades are liable. The article contains a plain statement of the causes producing the complaint, and of the precautions necessary to prevent their action.

Dr. Christison commences with some observations on the various ways in which lead enters the system, which we do not think it necessary to extract, and then proceeds to make the following remarks on the trades which expose workmen to its influence.

[Com. Pub.

The most accurate information on this subject is contained in the work of Mérat. He places foremost in the list, miners of lead. In this country miners are now rarely affected, because the frequency of colica pictonum [painter's colic] among them formerly, lead their masters to study the subject, and to employ proper precautions for

removing the danger. It has been stated by Dr. Percival, and is generally thought, that the whole of the workmen in lead mines are apt to be attacked with the colic,—those who dig the sulphuret, as well as those who roast the ore.* If this idea were correct, it would be in contradiction with the general principle in toxicology, that the metals are not poisonous unless oxidated. But the opinion is in all probability founded on error; for I am informed by *Mr. Braid*, who was some years surgeon at Leadhills in Lanarkshire, that the workmen who dig and pulverize the ore there, although liable to various diseases connected with their profession, and particularly to pectoral complaints, never have the lead colic until they also work at the smelting furnaces. Next to miners may be ranked manufacturers of litharge, red lead, and white lead. The workmen at these manufactories are exposed to inhale the fumes from the furnaces, or the dust from the pulverizing mills. It is chiefly among the workmen of a white lead manufactory in the neighbourhood of Edinburgh that I have had an opportunity of witnessing the lead colic. By a simple change the proprietor lately made in the process, and which will be mentioned presently, the disease has been almost extirpated.

Next in order, perhaps among the same class with colour-makers, are house painters. The cause of their liability is the great quantity of the preparations of lead contained in the paints they use. It would appear that lead colic is most frequent among people of that trade in cities of the largest size. In Geneva, I am informed by my friend *Dr. C. Coindet* of that place, colica pictonum is now almost unknown, and never occurs among painters. In Edinburgh it is also little known among painters. A journeyman painter, a patient of mine in the infirmary, had been seventeen years in the trade, and yet did not know what the painter's colic, or lead palsy, meant. In London, according to the dispensary reports, and in Paris, according to the tables of Mérat, many workmen of the trade suffer. I have been informed by an intelligent workman, once a patient of mine, who had been a journeyman painter both in London and in Edinburgh, that the number of his acquaintances who had been affected with the colic in the metropolis was incomparably greater than here. This man ascribed the difference to the working hours being more in the former place, so that the men had not leisure enough to make it worth their while to clean themselves carefully in the intervals. This appears a very rational explanation. I do not know how the great prevalence of colic among painters in Paris is to be accounted for. Plumbers, sheet-lead manufacturers, and lead pipe makers, are also, for obvious reasons, apt to suffer, but as they are not necessarily exposed to the vapours of lead, and suffer only in consequence of handling it in the metallic form, it ought to be an easy matter to protect them. They themselves conceive that a very hazardous part of their occupation is the removing of the melted lead from the melting pot to make the sheets or pipes; but this operation is not dangerous if the melting pots are properly constructed. A few cases of lead colic occur among glass-blowers, glaziers, and potters, who use the oxide of lead in their

* On the Poison of Lead, p. 22.

respective manufactures. There are a few also among lapidaries, and others, who use it for grinding and polishing stones or metals, and among grocers and colourmen who sell its various preparations. Printers are rarely attacked with the colic, but they are generally considered to be subject to partial palsy of the hands, which is ascribed to the frequent handling of the types. I have met with one case apparently of this nature. Lead is not the only metal to which the power of inducing colica pictonum has been ascribed. *Mérat* has mentioned several instances of the disease occurring among brass-founders and other artisans who work with copper.* *Tronchin* quotes Scheuchzer for a set of well-marked cases which happened in a convent of monks, and where the malady was supposed to have been traced to all the utensils for preparing and keeping their food, having been made of untinned copper.† The same author mentions two cases, one of which came under his immediate notice, where the apparent cause was the long-continued use of antimonial preparations internally.‡ Mérat has likewise found a few iron-smiths and white-iron-smiths in the list kept at one of the Parisian hospitals.§ Cases of colica pictonum have even been noticed by Mérat among varnishers, plasterers, quarrymen, stone hewers, marble workers, statuaries, saltpetre makers;‖ and Tronchin enumerates among its causes the immoderate use of acid wine or of cider, checked perspiration, sea scurvy, melancholy. But the only substance besides lead, whose operation in producing colica pictonum has been traced with any degree of probability, is copper; and even among those artisans who work with copper the disease is very rare. As to the other tradesmen mentioned by Mérat, it is so very rare among them, that we may safely impute it, when it does occur, to some other cause besides what the trade of the individual exposes him to; and in general the secret introduction of lead into the body, may be presumed to be the real origin of his malady. Still, however, the connexion of colica pictonum with other causes besides the poison of lead, is upheld by so many facts, and is believed by so many authorities, that this disease cannot be safely assumed, even in its most characteristic form, as supplying undoubted evidence of the introduction of lead into the system.

The work of Mérat contains some interesting numerical documents, illustrative of the trades which expose artisans to colica pictonum. They are derived from the lists kept at the hospital of La Charitè in Paris, during the years 1776 and 1811. The total number of cases of colica pictonum in both years was 279. Of these 241 were artisans, whose trades exposed them to the poison of lead, namely, 148 painters, 28 plumbers, 16 potters, 15 porcelain-makers, 12 lapidaries, 9 colour-grinders, 3 glass-blowers, 2 glaziers, 2 toy-men, 2 shoemakers, a printer, a lead-miner, a leaf-beater, a shot manufacturer. Of the remainder, 17 belonged to trades in which

* De la Colique Metallique.
† De Colica Pictonum, p. 56.
‡ De Colica Pictonum, p. 65.
§ De la Colique Metallique, p. 23.
‖ De la Colique, Passim.

they were exposed to copper, namely, 7 button-makers, 5 brass founders, 4 brasiers, and a copper-turner. The remaining twenty-one were tradesmen, who worked little, if at all, with either metal, namely, 4 varnishers, 2 gilders, 2 locksmiths, a hatter, a saltpetre-maker, a wine-grocer, a vine-dresser, a labourer, a distiller, a hatter, a stone-cutter, a calciner,* a soldier, a house servant, a waiter, and an attorney's clerk. Age or youth seems not to afford any protection against the poison. Of the 279 cases, 24 were under 20, and among these were several painter-boys, not above fifteen years old; 113 were between nineteen and thirty; 66 between twenty-nine and forty; 38 between thirty-nine and fifty; 28 between forty-nine and sixty; and 10 older than sixty. These proportions will correspond pretty nearly with the relative number of workmen of similar ages. Among the 279 cases, fifteen died, or 5.4 per cent.

* * * * *

The mode of preventing the influence of the poison becomes a subject of great importance; and more particularly when we consider the vast number of workmen in different trades, whose safety it is calculated to secure.

On this subject many useful instructions are laid down in the work of *Mérat*. He very properly sets out with insisting on the utmost regard being paid to cleanliness,—a point too much neglected by most artisans, and neglected particularly by those to whom it is most necessary, the artisans who work with the metals. In proof of the importance of this rule he observes, he knew a potter who contracted the lead colic early in life, when he was accustomed to go about very dirty, but for thirty years after had not any return of it, in consequence simply, of a scrupulous attention to cleanliness. In order to secure a due degree of cleanliness, three points should be attended to. In the first place the face and hands should be washed once a day at all events, the mouth well rinsed and the hair occasionally combed. Secondly, frequent bathing is of great consequence, both with a view to cleanliness and as a general tonic; so that masters should make it an object to provide their workmen with sufficient means and opportunities for practising it. Lastly, the working clothes should be made, not of woollen, but of strong, compact linen, should be changed and washed at least once, and still better twice, a week, and should be worn as little as possible out of the workshop. While at work a cap of some light impervious material should always be worn.

Next to cleanliness, the most important article of the general prophylaxis, relates to the means to be employed for preventing the food of the workmen from being impregnated with lead. For this end it is essential that they never take their meals in the workshop, and that before eating they wash the lips and hands with soap and water, and brush out all particles of dirt which may have lodged under the nails. It is also of some moment that they breakfast before going to work in the morning.

Derangements of the digestive organs should be watched with

* *Calcineur*,—a calciner of gypsum, I believe.

great care. If they appear to arise from the poison of lead, the individual should, with the very first symptom, leave off working and take a laxative. Habitual constipation should be provided against.

The nature of the diet of the workmen is of some consequence. It should be as far as possible of a nutritive and digestible kind. There is some reason for believing that the free use of fat and fatty articles of food is a preservative. *Dehaën* was told by the proprietor and physician of a lead mine in Styria, that the work people were once very liable to colic and palsy, but that, after they were told by a quack doctor to eat a good deal of fat, especially at breakfast, they were exempt from these diseases for three years.* Another fact of the kind was communicated to *Sir George Baker*, by a physician at Osterhoüt, near Breda. The village used to be the residence of a great number of potters, among whom he did not witness a single case of lead colic in the course of fifteen years, and he attributes their immunity to their having lived much on cheese, butter, bacon, and other fatty kinds of food.† Mr. Wilson says, in his account of the colic at Lead-hills, in Lanarkshire, that English workmen, who live much on fat meat, suffer less than Scotchmen, who do not.‡

Some have likewise proposed, as an additional preservative, that the exposed parts of the body should be anointed with oily or fatty matters. But *Mérat* maintains with some reason, that the lead will be thereby enabled to penetrate the cuticle more easily by friction and pressure.

The observance of the preceding rules will depend, of course, in a great measure, on the intelligence and docility of the workmen, directed by the vigilance and authority of their masters.

Some other objects, also of much consequence, are to be attained by the humanity and skill of the masters only.

The workshop should be spacious, and both thoroughly and systematically ventilated; the external air being freely admitted when the weather will allow, and particular currents being established, by which floating particles are carried through the workshop in certain invariable and known courses. Miners, and others who work at furnaces in which lead is smelted, fused, or oxidated, should be protected by a strong draught through the furnaces. Mr. Braid informs me, that wherever furnaces of such a construction have been built at Lead-hills, the colic has disappeared, while it continues to recur where furnaces are still used of the old, low-chimneyed, form. Manufacturers of litharge and red lead, used formerly to suffer much in consequence of the furnaces being so constructed, as to compel them to inhale the fine dust of the oxides. In drawing the furnaces the hot material is raked out upon the floor, which is two or three feet below the aperture in the furnace; and the finer particles are

* Ratio Medendi, p. 1. c. 9. de Variis.
† Trans. of London Coll. of Phys. 2. 457.
‡ Ed. Phys. and Lit. Ess. 1. 521.

therefore driven up and diffused through the apartment. But this obvious danger is now completely averted by a subsidiary chimney, which rises in front of the drawing aperture, and through which there is a strong current of air attracted from the apartment, the hot material on the ground performing the part of a fire.

In white lead manufactories a very important and simple improvement has been effected of late, in some places, by abandoning the practice of dry grinding. In all manufactories of the kind, the ultimate pulverizing of the white lead has been long performed under water. But in general, the preparatory process of rolling, by which the carbonate is separated from the sheets of lead on which it is formed, continues to be executed dry. This is a very dangerous operation, because the workmen must inhale a great deal of the fine dust of the carbonate. In an extensive white lead manufactory at Portobello, the process is entirely performed under water, or with damping; and to this precaution, in a great measure, are imputed the improvement which has taken place in the health of the workmen, and their superior immunity from disease, over those of Hull and other places, where I am informed the same precaution is not taken.

The only operation now considered dangerous at the Portobello works, is the emptying of the drying stove, and the packing of the white lead in barrels; and the dust which is then diffused is kept down as much as possible, by the floor being maintained constantly damp. By these precautions, and by care being taken to make the workmen wash their hands and faces before leaving the works for their meals, and to administer a brisk dose of castor oil on the first appearance of any complaint of the stomach or bowels, the manufacturer succeeded in extirpating the colica pictonum entirely for several years. Last year it appeared again to a limited extent among the work people, apparently in consequence of the rules as to cleanliness, not having been so carefully enforced.

Remarks on the Different Modes of Applying power for Locomotive Purposes.

(Concluded from page 262.)

Before leaving the subject, it may not be reckoned improper to estimate the facilities which the condensed air system affords to locomotion on common roads. It has already been observed, that the various inconveniences and obstacles which present themselves in regulating the supply of steam power to meet an ever-varying opposing force have, as yet, entirely prevented its effectual application on common roads. By applying a reservoir of condensed air, however, and the necessary apparatus of communication, this hinderance is removed, and in every case of expenditure the greatest economy is introduced. To gain a complete knowledge of its expediency, it therefore only remains to have an accurate notion of the additional weight of the reservoir and machinery requisite to retain, with most perfect safety, the necessary quantity of power. To avoid circumlocution, these several advantages may be conveniently displayed in the form of a table, which is arranged in the following manner:—

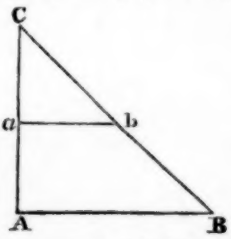
1	2	3	4	5	6
Height of Ascent.	Contents of Reservoir in Cubic feet.	Diameter of Reservoir in Feet.	Thickness of Reservoir in Inches.	Weight of Reservoir in lbs. Avoird.	Horizontal Length in Miles.
0	65.710	4.035	.605	1238	10.000
50	66.954	4.061	.609	1262	10.189
100	68.198	4.086	.613	1287	10.379
150	69.442	4.110	.616	1311	10.668
200	70.686	4.135	.620	1336	10.758
250	71.930	4.160	.624	1360	10.947
300	73.174	4.183	.627	1384	11.137
350	74.418	4.204	.631	1408	11.326
400	75.662	4.228	.634	1432	11.516
450	76.906	4.252	.638	1455	11.705
500	78.150	4.277	.641	1477	11.896
550	79.394	4.298	.645	1499	12.084
600	80.638	4.320	.648	1520	12.274
800	85.614	4.408	.661	1615	13.032
1000	90.590	4.491	.674	1709	13.790
1500	103.030	4.688	.703	1936	15.685
2000	115.470	4.870	.730	2176	17.580
2357	124.352	5.000	.750	2356	18.932

The first column presents the height in feet which has to be overcome, and is equal to the sum of the height of all the inclinations of ascent, which is gone over in the horizontal distance of 10 miles. The second shows the number of cubic feet of air, having 50 atmospheres' condensation contained in the reservoir, being 5 times the quantity of power necessary to impel the loaded coach, reservoir, and machinery, estimated at 6 tons, over a horizontal distance of 10 miles (the force of traction being estimated at $\frac{1}{20}$ the whole load,) and up ascending inclinations, the sum of the vertical heights of which are considered variable, and denoted by the figures in the first column. The quantities in this column are calculated from the formula $SW = \frac{15\,A^2\,C}{2}$, already explained and demonstrated. The third column shows the corresponding diameters of the reservoir, considered as a spherical shell. The fourth column shows the requisite thickness of the reservoir—supposed to be malleable iron—having a cohesive force of 75,000 lbs. to the square inch, one-fifth of which being taken as the quantity M in the formula $t = \frac{pD}{4M}$ (see note A,) from which the figures in this column were calculated. The fifth column represents the corresponding weight of the reservoir, a cubic foot of the iron being supposed to weigh 480 lbs; the formula being $\frac{480 \times 3.1416 \times D^2\,t}{1728} = D^2\,t \times .873 =$ weight in lbs. The figures in the sixth or last column, represent the respective distances to which the coach would proceed on a level road, having a reservoir with dimensions, &c. as specified in the foregoing columns.

This table appears to show satisfactory evidence of the practica-

bility of this system on common roads, and the only difficulty which can remain to lead to different conclusions is the uncertainty of an efficient mode for the direct application of the power. If this were discovered, and all the practical difficulties removed, it must be encouraging to reflect that a coach, weighing 6 tons, including a reservoir of condensed air, 5 feet in diameter, and weighing one ton, could move at almost any velocity over a distance of 17 miles, and ascend inclinations having a total vertical height of 1500 feet. (Note B.)

(Note B.)—To the great velocity to which locomotive steam carriages aspire, the resistance of the air must prove a serious obstacle. Of late a speed of 40 or 50 miles an hour is said to have been attempted—it will be interesting to calculate the exact amount of this resistance. A body descending by the force of gravity continually receives new impressions, equal in equal times, which introduces an equably accelerated velocity. This velocity continually increasing, may be represented by one side, AB, of a triangle, whilst the other side, AC, may represent the time elapsed since the commencement of the motion, which likewise undergoing a simultaneous increase, AB will always be proportional to AC. In ascertaining the resistance of air, the pressure of this resistance is to be compared with the force of gravitation. With regard to the former we have to observe, that the velocity being uniform, the quantity of matter varies; let AC, in this instance again, represent the time, and AB the distance gone over in this time, or the quantity of air which impinges against the carriage. It is evident, that in a small instant *a*C the velocity being uniform, the quantity of air which has impinged during the lapse of this instant is proportional to *a*C, and may be represented by *ab*, which is to *a*C::AB.AC. In gravitation, therefore, the quantity of matter is constant, the velocity increasing with the time, whilst in the resistance of air or any other fluid the velocity is constant whilst the matter augments with the time. If then in equal time AC.AC, the two products AB.AC, AB.AC, are equal, the pressure and resistance mutually balancing each other, an equilibrium will take place. This may be understood likewise from considering that momentum of every kind is compounded of the velocity of the moving body, and the quantity of matter which is in this body, both being equally necessary to the production of motion, if in one case the velocity augments whilst the quantity of matter is constant, the resulting momenta are the same as if the quantity of matter increased in an equal ratio and the velocity remained constant. To illustrate this by a practical example, we may attempt by this method to calculate the resistance of a square foot of surface moving in air at the velocity of 30 miles an hour. Assuming the specific gravity of air as ·0012, water being 1, and a cubic foot of it weighing 62½ lbs. the distance moved over in a second will be $\frac{30\times5280}{3600}=1.47\times30=44$ feet, and the quantity of matter impinging in that time $=44\times.0012\times62.5=3.3$ lbs. the product of this quantity by 44 (or the velocity,) and divided by 32 17 (the force of gravity) will give the number of pounds pressure on the square foot, or $\frac{44\times3.3}{32\cdot17}=4.536$ lbs. In this manner, A representing the velocity in miles per hour, we obtain the formula $\frac{\left(\frac{A\ 5280}{3600}\right)^2.075}{32.166}=.00504\ A^2$ lbs.=the pressure on a square foot of surface moving in air at the rate of A miles an hour.—See Table in the following page.



Surely such conclusions afford the greatest encouragement for a practical trial of the system; and if found to succeed, the advantages to be derived from its application must prove incalculable. The steam-engine would acquire double value and efficacy, and, from its superior economy and convenience, might tend to abridge, and finally abolish, every description of animal labour. Altogether, the subject, however much at present it wants the aid of practical experience, is not unworthy of public attention, and from the eminent good which is likely to spring from it, seems well calculated to excite the efforts of ingenious and enterprising engineers. The object of the foregoing remarks has chiefly been to rouse the attention of your correspondents to the subject. A patent has been taken out by a gentleman in Wales for this mode of stowing and applying power, but not having heard of its having, as yet, undergone any experimental trial, it would be highly interesting if any of your readers could supply any information upon this subject, and would much oblige, sir, your obedient servant,

Edinburgh, Nov. 1830. N. S. N.

Miles per Hour.

	Square feet of opposing resistance.																
	1	4	8	12	16	20	24	28	32	36	40						
1	.00504	.02016	.04032	.06048	.08064	.10080	.12096	.14112	.16128	.18144	.29160						
5	.126	.504	1.008	1.512	2.016	2.520	3.024	3.528	4.032	4.536	5.040						
10	.504	2.016	4.032	6.048	8.064	10.080	12.096	14112	16.128	18.144	20.160						
15	1.134	4.536	9.072	13.608	18.14	22.68	27.22	31.75	36.29	40.82	45.36						
20	2.016	8.064	16.13	24.19	32.26	40.32	48.38	56.45	64.51	72.58	80.64						
25	3.150	12.60	25.20	37.80	50.40	63.00	75.60	88.20	100.8	113.4	126.0						
30	4.536	18.14	36.29	54.43	72.58	90.72	108.86	127.01	145.15	163.30	181.4						
35	6.174	24.70	49.39	74.09	98.78	123.5	148.2	172.9	197.6	222.3	247.0						
40	8.064	32.26	64.51	96.77	12982	161.28	193.54	225.8	258.1	290.3	322.6						
45	10.21	40.8	81.65	122.47	163.3	204.1	245.0	285.8	326.6	367.4	408.2						
50	12.60	50.4	100.8	151.2	201.6	252.	302.4	352.8	403.2	453.6	504.0						

[*Mechanics' Magazine.*

To our Readers.

We are promised that a further portion of the Report of the Committee on Water Power will be in readiness to present to our readers in the number for June next: the nature of the calculations must necessarily produce intervals between the appearance of the different parts of this Report.

COMMITTEE ON PUBLICATIONS.

Meteorological Observations for March, 1831.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2, P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain and snow.	State of the weather, and Remarks.
				Inches	Inches.			Inches.	
	1	30°	54°	30.15	30.15	W. W.	Calm.		Clear. Clear.
	2	38	58	.26	29.95	W. S.	do.	.02	Clear—*river open*—rain.
	3	46	54	29.93	.83	W. W.	Moderate.		Clear. Cloudy.
	4	34	48	.90	.92	W. SW.	do.		Clear. Cloudy.
	5	44	62	.80	.85	W. W.	do.	.19	Cl'dy-cl'dy-rain in night.
☾	6	48	43	.85	.84	S. S.	do.	.17	Cloudy—cloudy—rain.
	7	39	49	.70	.70	SW. W.	Blustering.	.01	Fog—flying clouds—rain.
	8	30	43	.90	30.00	W. W.	Moderate.		Clear—flying clouds.
	9	30	50	.95	29.80	S. S.	do.	.01	Cl'dy—clear—slight rain.
	10	32	44	.80	.85	W. W.	do.		Clear. Clear.
	11	29	50	30.00	30.00	SE. S.	do.		Clear—white frost—clear.
	12	37	58	29.80	29.70	SW. S.	do.		Cloudy. Cloudy.
	13	32	52	.53	.50	W. W.	Blustering.		White frost-fog-fly. cl'ds.
⊗	14	32	42	.65	.75	do.	do.		Clear—flying clouds.
	15	31	56	.75	.83	do.	Moderate.		Clear. Clear.
	16	48	48	.65	.65	SW. W.	do.		Cloudy cloudy—drizzle,
	17	34	26	.60	.60	SE. NW.	Blustering.	.16	Cloudy—snow squall.
	18	20	38	30.20	30.20	W. SW.	Moderate.		Clear. Clear.
	19	34	43	29.74	29.60	S. W.	Blustering.	.20	Rain—flying clouds.
☽	20	29	38	.72	.83	W. W.	do.		Clear. Clear.
	21	23	43	30.15	30.25	do.	Moderate.		Clear. Clear.
	22	29	54	.25	.25	do.	do.		Clear—white frost—clear.
	23	39	63	.15	.15	SW. S.	do.		Cloudy—hazy. [lun. halo.
	24	49	60	.09	29.90	S. S.	do.	.35	Rain—thunder shower.
	25	56	64	29.63	.63	W. W.	do.		Flying cl'ds—flying cl'ds.
	26	48	62	.70	.70	W. SW.	do.		Clear. Clear.
	27	47	64	.60	.60	S. W.	Blustering.	.66	Clear. Clear.
☉	28	44	54	.90	.95	N. NE.	Moderate.		Clear. Overcast.
	29	41	44	.90	.89	E. SE.	do.		Rain. Rain.
	30	47	48	.40	.25	SW. W.	Blustering.	1.30	Fog—rain—cloudy.
	31	41	68	.70	.60	SW. S.	do.	.04	Clear—clear—shower in the evening.
	Mean	37.45	50.96	29.85	29.83			3.11	

	Thermometer.		Barometer.	
Maximum height during the month,	68.	on the 31st	30.26	on the 2nd.
Minimum do.	20.	on the 18th,	29.25	on the 30th.
Mean do.	44.20		29.84	
Water fallen in snow and rain,	3.11 inches.			